



The Burden of
**Heart Disease
and Stroke**
in Tennessee

Tennessee Department of Health
in collaboration with
Tennessee State University and
University of Tennessee Health Science Center

2006

THE BURDEN *of* **HEART DISEASE** *and* **STROKE** *in* **TENNESSEE**

Technical Report

TENNESSEE DEPARTMENT OF HEALTH
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EXECUTIVE SUMMARY

Purpose

The purpose of this report is to document Tennessee's burden of diseases of the heart and stroke from 1996 to 2002. Heart disease and stroke are the two most common forms of cardiovascular disease, and they are also the first and third leading causes of death in the United States and Tennessee. This report includes trends in risk factors that increase risk for heart disease and stroke; trends in the occurrence of diseases of the heart, stroke, and hypertension; and trends in health service utilization and costs associated with these conditions. This report is intended as a resource for public health planners, policy makers, advocates, providers, researchers, and the general public.

Data Sources

Four sources of data were used: (1) Behavioral Risk Factor Surveillance System (BRFSS) representing Tennessee adults, 1996-2002; (2) Hospital Discharge Data System (HDDS) for all ages in Tennessee, inpatient and outpatient files, 1997-2002; (3) Medicare billing data from Centers for Medicare and Medicaid Services (CMS) for ages 65 and over in Tennessee, inpatient, outpatient and carrier (physician) 1996-2002; and (4) Death Statistical System Summary (DSSS) for all ages in Tennessee, 1996-2002.

Key Findings

Modifiable Risk Factors: Nine out of ten adult Tennesseans reported at least one modifiable risk factor for heart disease and stroke, and 63% reported two or more risk factors, the most common of which were poor diet and sedentary lifestyle. The prevalence of some risk factors have remained fairly stable (current smoking and high cholesterol), some decreased only slightly (sedentary lifestyle and poor diet), and others increased at a disturbing rate (obesity and diabetes mellitus). Black women, especially, had a high prevalence for multiple risk factors

Diseases of the Heart: Nearly 70,000 (40,000 elderly) Tennesseans were hospitalized for DOH in 2002. Age-adjusted rates of DOH among inpatients increased by 4% from 1,140.7 to 1,189.5 per 100,000 population from 1997 to 2002. This rate decreased most for Black males. Age-adjusted rates of DOH among inpatients varied across Tennessee counties from 496.4 to 2,162.3 per 100,000 population. About 240,000 elderly had physician-diagnosed DOH in 2002 (age-adjusted rate 31,978.1/100,000). DOH rates were higher for men compared to women and higher for Blacks compared to Whites (although among the elderly, rates of physician-diagnosed DOH were higher for Whites).

About 2/3 of people with DOH had HTN, 1/4 to 1/3 had diabetes mellitus (DM), and 30-40% had high cholesterol (HCL). One-third of people with DOH had two co-morbid conditions, and about 10% had all three conditions. Blacks with DOH were more likely to have co-morbid HTN or HTN/DM, while Whites were more likely to have co-morbid HCL or HTN/HCL.

DOH caused around 16,000 deaths per year in Tennessee, including 13,000 deaths (80%) among the elderly. The age-adjusted mortality rate from DOH decreased by 9% from 313.6 to 284.7 per 100,000 deaths from 1996 to 2002 (which was higher than the national mortality rate from DOH). DOH accounted for 28.7% of all deaths in Tennessee in 2002. DOH mortality rates were higher for men compared to women and higher for Blacks compared to Whites, with Black males having the highest rates.

Coronary Heart Disease: Nearly 36,000 (18,000 elderly) Tennesseans were hospitalized for CHD in 2002. Age-adjusted rates of CHD among inpatients decreased by 2% from 617.7 to 604.9 per 100,000 population from 1997 to 2002. About 124,000 elderly had physician-diagnosed CHD in 2002 (age-adjusted rate 16,414.8/100,000). CHD rates were higher for men compared to women and higher for Blacks compared to Whites (but higher for Whites among the elderly). CHD caused around 12,000 deaths per year in Tennessee, including 10,000 deaths (80%) among the elderly. The age-adjusted mortality rate from CHD decreased by 12% from 243.9 to 215.1 per 100,000 deaths from 1996 to 2002. CHD mortality rates were higher for men compared to women and higher for Blacks compared to Whites, and highest for Black males even though White males had higher age-adjusted rates of CHD as inpatients.

Myocardial Infarction: Six percent of Tennessee adults report ever having a physician-diagnosed heart attack, with higher prevalence for men and Whites. Nearly 14,000 (8,000 elderly) Tennesseans were hospitalized for MI in 2002. Age-adjusted rates of MI among inpatients increased by 3% from 239.8 to 245.8 per 100,000 population from 1997 to 2002. About 12,000 elderly had physician-diagnosed MI in 2002 (age-adjusted rate 1,576.5/100,000). MI rates were higher for men compared to women and higher for Blacks compared to Whites as inpatients (but higher for Whites among the elderly). MI caused around 5,500 deaths per year in Tennessee, including 4,300 deaths (80%) among the elderly. The age-adjusted mortality rate from MI decreased by 17% from 111.3 to 92.1 per 100,000 deaths from 1996 to 2002. MI mortality rates were higher for men compared to women and higher for Whites compared to Blacks.

Congestive Heart Failure: Nearly 18,000 (12,000 elderly) Tennesseans were hospitalized for CHF in 2002. Age-adjusted rates of CHF among inpatients increased by 7% from 285.6 to 305.1 per 100,000 population from 1997 to 2002. About 61,000 elderly had physician-diagnosed CHF in 2002 (age-adjusted rate 1,714.5/100,000). CHF rates were higher for men compared to women and substantially higher for Blacks compared to Whites. CHF caused around 500 deaths per year in Tennessee, mostly among the elderly. The age-adjusted mortality rate from CHF increased by 10% from 1996 to 2002. CHF mortality rates were higher for men compared to women, although there was higher for Blacks in most years.

Stroke: Among Tennessee adults, 3.6% report ever having a physician-diagnosed stroke, with higher prevalence for men and Blacks. Nearly 20,000 (14,000 elderly) Tennesseans were hospitalized for stroke in 2002. Age-adjusted rates of stroke among inpatients decreased by 2% from 352.5 to 346.7 per 100,000 population from 1997 to 2002. Age-adjusted rates of stroke among inpatients varied across Tennessee counties from 186.5 to 599.9 per 100,000 population. About 73,000 elderly had physician-diagnosed stroke in 2002 (age-adjusted rate 9,872.0/100,000). Stroke rates were higher for men compared to women and higher for Blacks compared to Whites (although among the elderly, rates of physician-diagnosed stroke were higher for women and Whites).

The pattern of co-morbidity with stroke was the same as the pattern for DOH, with the exception that co-morbid HTN was more common among people with stroke. Stroke caused around 4,000 deaths per year in Tennessee, including 3,500 deaths (87%) among the elderly. The age-adjusted mortality rate from stroke decreased by 11% from 79.7 to 70.8 per 100,000 deaths from 1996 to 2002. Stroke accounted for 7.0% of all deaths in Tennessee in 2002. Stroke mortality rates were higher for Blacks compared to Whites and higher for women compared to men, given that mortality rates from stroke decreased more rapidly for men than women in recent years.

Transient Ischemic Attacks: Over 4,000 (more than 3,000 elderly) Tennesseans were hospitalized for TIA in 2002. Age-adjusted rates of TIA among inpatients only increased by 1% from 72.3 to 72.7 per 100,000 population per 100,000 population from 1997 to 2002. About 19,000 elderly had physician-diagnosed TIA in 2002 (age-adjusted rate 421.8/100,000). TIA rates were higher for women compared men to and higher for Blacks compared to Whites (although among the elderly, rates of physician-diagnosed TIA were higher for Whites).

Hypertension: Among Tennessee adults, 27-30% report ever having physician-diagnosed HTN, with higher prevalence for women and Blacks. Nearly 6,000 (3,000 elderly) Tennesseans were hospitalized for HTN in 2002. Age-adjusted rates of HTN among inpatients decreased by 3% from 111.0 to 108.5 per 100,000 population from 1997 to 2002. Age-adjusted rates of HTN among inpatients varied across Tennessee counties from 43.1 to 296.3 per 100,000 population. About 300,000 elderly had physician-diagnosed HTN in 2002 (age-adjusted rate 39,410.7/100,000). HTN rates were higher for women compared to men and higher for Blacks compared to Whites with highest rates for Black women.

HTN caused around 1,500 deaths per year in Tennessee, including 1,000 deaths (around 3/4) among the elderly. The age-adjusted mortality rate from HTN increased by 29% from 20.9 to 26.9 per 100,000 deaths from 1996 to 2002. HTN mortality rates were higher for men compared to women (even though women had higher rates as inpatients), and three times higher for Blacks compared to Whites.

Impact on Health Service Utilization: For DOH, the total annual number of inpatient visits increased by 11% from 81,220 to 90,458 from 1997 to 2002 (with a greater increase for Whites), accounting for around 12% of all inpatient visits. For DOH, the average length of stay (LOS) for hospitalizations decreased by 3% from 5.3 to 5.1 days, while the total annual number of inpatient days for DOH increased by 8% from 427,038 to 459,879 during this time period. LOS for DOH tended to be slightly longer for females compared to males, and about a day longer for Blacks compared to Whites. Over half of inpatient hospitalizations for DOH were admitted through the ER (with a greater percentage for females and Blacks). The total annual number of outpatient visits for DOH increased by 80% from 28,718 to 51,765 from 1997 to 2002, with a two-times greater increase for Whites

compared to Blacks. Nearly half of outpatient visits for DOH consisted of visits to the ER (with a greater percentage for females and Blacks). Elderly individuals with DOH had 22.3 physician visits in 2002 (higher for women and Blacks), for whom DOH was the primary diagnosis for around 9% of all physician visits.

For **stroke**, the total annual number of inpatient visits increased by 8% from 21,120 to 22,844 from 1997 to 2002, accounting for around 3% of all inpatient visits. For stroke, the average LOS increased by 7% from 5.7 to 6.0 days, and the total annual number of inpatient days for stroke increased by 15% from 119,651 to 137,839 during this time period. LOS for stroke tended to be Almost 75% of Black and about 60% of White inpatient hospitalizations for stroke were admitted through the ER (with a greater percentage for females and Blacks). For stroke, the total annual number of outpatient visits increased by 92% from 3,377 to 6,487 from 1997 to 2002, with a four-times greater increase for Whites compared to Blacks. Nearly 80% of outpatient visits for stroke consisted of visits to the ER. Elderly individuals with stroke had 4.2 physician visits in 2002 (higher for women and Blacks), and stroke was the primary diagnosis for around 2% of all physician visits for the elderly.

For **HTN**, the total annual number of inpatient visits increased by 4% from 6,852 to 7,091 from 1997 to 2002 (with a greater increase for Blacks), accounting for around 1% of all inpatient visits. For HTN, the average LOS remained stable around 5.0-5.2 days, and the total annual number of inpatient days for HTN increased by 3% from 35,932 to 37,039 during this time period. LOS for HTN tended to be slightly longer for females compared to males, and slightly longer for Blacks compared to Whites. Almost three-fourths of Black and over half of White inpatient hospitalizations for HTN were admitted through the ER (with a greater percentage for females). For HTN, the total annual number of outpatient visits increased by 79% from 8,631 to 15,407 from 1997 to 2002, with a two-times greater increase for Whites compared to Blacks. Around three-fourths of outpatient visits for HTN consisted of visits to the ER (with a greater percentage for females and Whites). Elderly individuals with HTN had 3.4 physician visits in 2002 (higher for Blacks), for whom HTN was the primary diagnosis for around 5% of all physician visits.

Procedures: The total number of cardiac and vascular procedures performed each year in an inpatient setting (for all ages) increased by 21% from 33,236 in 1997 to 40,187 in 2002. The number of inpatients receiving specific procedures were in 2002 were as follows: cardiac catheterization (10,165), coronary artery bypass graft (8,550), angioplasty and stenting (12,409), open heart surgery (854), heart valve surgery (185), and heart transplant (36). The inpatient procedures with the greatest increase in frequency from 1997 to 2002 were open heart surgery and heart valve surgery, especially among Whites. The number of cardiac catheterization procedures performed each year in an outpatient setting increased by 120% from 1997 to 2002 (16,727 performed). The number of angioplasty and stenting procedures performed each year in an outpatient setting increased, especially for Blacks, by 268% from 1997 to 2002 (2,350 performed).

Impact on Health Care Costs:

Total Costs: The total cost for inpatient services for all diseases increased 61% from \$6.9 billion in 1997 to \$11.1 billion in 2002. DOH, stroke and HTN inpatient cost also increased from 1997 to 2002 at similar extent to the total cost (\$2.1 billion for DOH, \$395 million for stroke, and \$115 million for HTN in 2002). The total cost for physician services among the elderly increased 33% from \$1.05 billion in 1996 to \$1.4 billion in 2002. The cost of physician services for DOH and stroke increased to a smaller extent than the cost for all diseases (11% for DOH, 2% for stroke) but physician services cost for HTN increased to a higher extent than all diseases (31%). In 2002, the physician services cost was \$143 million for DOH, \$42 million for stroke and \$46 million for HTN.

Costs for DOH: For **DOH**, the age-adjusted per capita charges for inpatient services increased 43% from \$253 in 1997 to \$362 in 2002, which is much higher than the increase in age-adjusted inpatient rate (4%). This suggests that the increase in DOH inpatient cost was not due to the increase of inpatients alone. Males had higher age-adjusted per capita charges than females with White females being the lowest from 1997-2002. Among the elderly the age-adjusted per capita cost for DOH physician services increased by 4.8% from 1996-2002, which is much higher than the increase in physician-diagnosed DOH rates (2%). White males had the highest age-adjusted per capita charges while the other three gender-race groups were similar.

Costs for Stroke: For **stroke**, the age-adjusted per capita charges for inpatient services increased 45% from \$47 in 1997 to \$68 in 2002 despite the decreases in stroke hospitalization and mortality rates. The age-adjusted per capita charges for Blacks were more than twice as high as in Whites and the gap increased over time. Among the elderly the age-adjusted per capita cost for stroke physician services increased by 5% from 1996-2002, with White females being slightly higher than the other three gender-race groups.

Costs for HTN: For **HTN**, the age-adjusted per capita charges for inpatient services increased 54% from \$13 in 1997 to \$20 in 2002, despite the 3% of decrease in HTN hospitalization rate. The age-adjusted per capita charges

for Blacks (\$75) were more than 5 times higher than that for Whites (\$12) and the gap was also increasing over time. Among the elderly the age-adjusted per capita cost for HTN physician services increased by 37% from 1996-2002, with Black females being the highest and White males the lowest.

Payer: Medicare was the largest payer for all types of services and population age range, paying for 62-65% of DOH, stroke, and HTN cost in 2002 while TennCare paid for 9-12% and other insurance coverage paid for 17-25%. Tax payers (combination of Medicare and TennCare) paid for about three-fourths of the cost. Medicare paid for a higher proportion of the cost for females than males and a higher proportion for Whites than Blacks. TennCare paid for a higher percentage of the cost for Blacks than Whites, and other insurance coverage paid for a higher percentage of the cost for males than females.

Conclusions

Patterns in disease rates, health care utilization and mortality suggest that Blacks may be more likely to delay seeking care for DOH and stroke and present with more severe conditions compared to Whites. Increased utilization of effective inpatient and outpatient procedures, particularly when used as secondary preventive treatments, likely contributed to the decrease in DOH and stroke mortality rates as well as the constant increase in health care cost, however, these mortality rates are still much higher than the national average and disproportionately affect Blacks compared to Whites. The growing prevalence of modifiable risk factors, especially for Black females, needs to be targeted by public health programs. Future research should focus on identifying the causes of geographic disparities in heart disease and stroke, as well.

I. INTRODUCTION

A. Purpose of Report

The purpose of this report is to document Tennessee's burden of heart disease and stroke from 1996 to 2002. Heart disease and stroke are the two most common forms of cardiovascular disease, and they are also the first and third leading causes of death in the United States and Tennessee. This report includes trends in risk factors that increase risk for heart disease and stroke; trends in the occurrence of diseases of the heart, stroke, and hypertension; and trends in health service utilization and costs associated with these conditions. This report is intended as a resource for public health planners, policy makers, advocates, providers, researchers, and the general public.

B. Background

Cardiovascular Disease in the United States

In general, **cardiovascular disease (CVD)** refers to any of the diseases that affect the circulatory system, including heart disease, stroke, and other conditions.¹ **Diseases of the heart (DOH)** include coronary heart disease, myocardial infarction, congestive heart failure, and other conditions. **Stroke**, or cerebrovascular disease, generally refers to the interruption of blood supply to the brain due to either an obstruction or rupture of a blood vessel, and it encompasses conditions such as hemorrhage, infarction, occlusion, or stenosis in the brain and cerebral blood vessels. **Hypertension (HTN)**, or high blood pressure, is a form of cardiovascular disease in which the pressure in the arterial circulation is elevated. High blood pressure greatly increases the risk of developing heart disease and stroke.

DISEASES OF THE HEART (DOH): Recent estimates show that over 23 million Americans, or 11.1% of the total adult population, have some form of heart disease.² Prevalence of DOH is greater among men compared to women, and is greater among Whites compared to Blacks.² DOH is the leading cause of death in the United States. Nearly 700,000 Americans died of DOH in 2002 (age-adjusted death rate of 240.8 per 100,000 deaths), which was the primary cause for 28.7% of all deaths.³ DOH death rates are higher among men compared to women and higher among Blacks compared to Whites.³ Estimates from the *U.S. Decennial Life Tables* show that the elimination of DOH would increase U.S. life expectancy by 4.6 years.⁴ The three major types of DOH addressed in this report are **coronary heart disease**, **myocardial infarction**, and **congestive heart failure**.

Coronary heart disease (CHD) is caused by impaired circulation in one or more coronary arteries, and includes acute myocardial infarction, angina pectoris, and other forms of ischemic heart disease. CHD affects around 13 million Americans, or 6.9% of the total adult population.¹ Coronary heart disease is the single most common cause of death for both men and women in the U.S., causing 1 of every 5 deaths in general and over half of CVD deaths. The overall death rate from CHD in 2002 was 170.8 per 100,000 deaths, with higher rates for men compared to women and for Blacks compared to Whites.¹ Over 83% of deaths from CHD are among people age 65 and over.¹

Myocardial infarction (MI): Around 7.1 million Americans, or 3.5% of the total adult population, have suffered from MI (or heart attack), with an estimated 565,000 new attacks and 300,000 recurrent attacks annually.¹ In general, new heart attacks are more common among men compared to women and among Blacks compared to Whites, and black women tend to have new heart attacks at younger ages than White women.⁵ Given that women tend to have heart attacks at older ages than men do, 25% of men and 38% of women die within one year after having an initial recognized MI.⁶

Congestive heart failure (CHF) is an impairment in the pumping function of the heart due to heart disease. CHF affects 4.9 million Americans, or 2.3% of the total adult population, and prevalence is higher for Blacks compared to Whites.¹ At age 40, the lifetime risk of developing CHF is 1 in 5 for both men and women, and risk increases with age.⁷ HTN and MI greatly increase the risk of developing CHF.⁷ One in five adults with CHF die within one year of diagnosis, and around three-fourths of adults under age 65 diagnosed with CHF die within eight years.⁶

STROKE: Around 5.4 million Americans, or 2.6% of the total adult population, have had a stroke, with an estimated 500,000 new attacks and 200,000 recurrent attacks annually.¹ In 2002, stroke accounted for approximately 7.0% of deaths in Tennessee. Incidence rates for strokes are higher among men (1.25 times greater than for women), and Blacks have almost twice the risk of stroke compared to Whites.¹ The number of non-institutionalized stroke survivors is increasing, and age-adjusted death rates from stroke are falling with better care and treatment (although the actual number of stroke deaths has risen).^{1,8} However, in 2002, over 162,000

Americans died from stroke, which accounted for 1 in 15 deaths. Because women live longer than men, more women die of stroke each year than men, and death rates are higher for Blacks compared to Whites.¹ In addition, the prevalence of, **transient ischemic attacks (TIA)**, or mini-strokes that last less than 24 hours) increases with age, with prevalence among 65-69 year-olds at 1.6% for women and 2.7% for men, compared to 75-79 year-olds who have prevalence rates of 4.1% for women and 3.6% for men.³

HYPERTENSION (HTN), or high blood pressure, is the most prevalent form of cardiovascular disease, afflicting nearly 1 in 3 U.S. adults age 18 and older.⁴ The prevalence of HTN is higher among men compared to women under age 55, while women have higher prevalence after age 55.¹ Prevalence of HTN is higher among African Americans compared to White Americans.¹

Cardiovascular Mortality in Tennessee

Figure 1.1. illustrates the major causes of death for the state of Tennessee in 2002. Together, DOH, stroke, and other cardiovascular diseases were responsible for 38.2% of Tennessee deaths in 2002. DOH was the number one killer in Tennessee in this year, causing 28.7% of deaths, while stroke caused 7.0% and other cardiovascular diseases caused 2.5% of deaths. The second most common killer was cancer, causing 22.1% of deaths in Tennessee in 2002. After stroke, other common causes of death included chronic lower respiratory diseases (5.3%), accidents (4.8%), diabetes mellitus (3.1%), and influenza and pneumonia (3.0%).

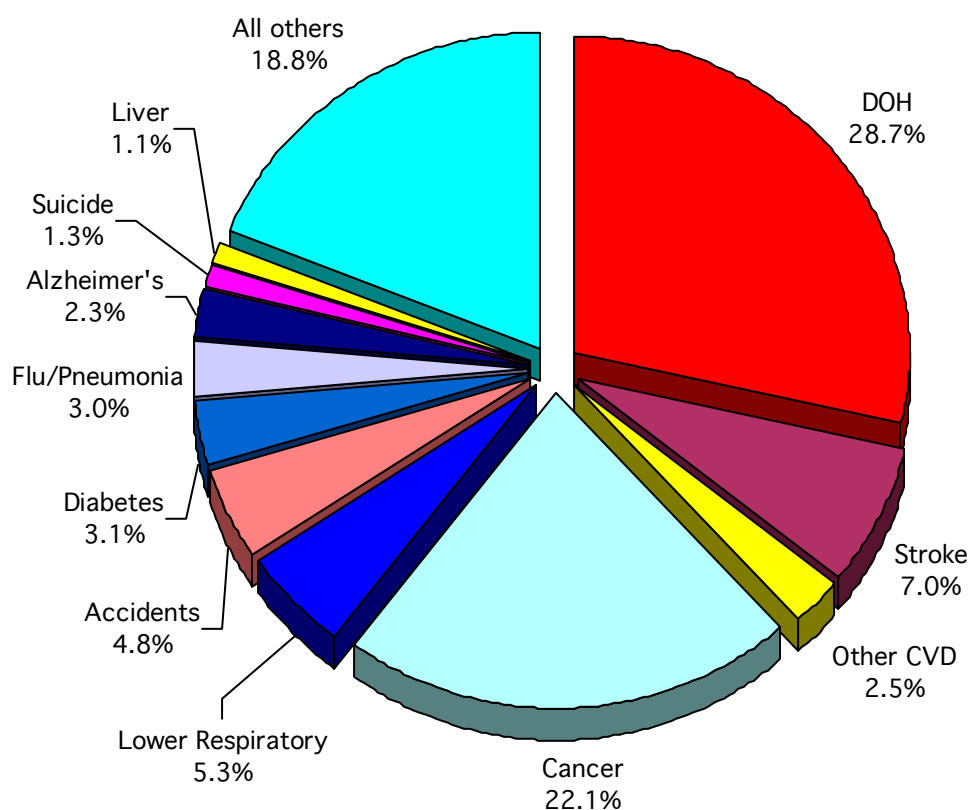


Figure 1.1. Leading Causes of Death in Tennessee in 2002

Source: Report of Tennessee Deaths 2002, Tennessee Dept of Health, Division of Health Statistics

Cardiovascular Risk Factors

The risk of developing heart disease or stroke increases substantially with **age**. For example, annual incidence rates for first major cardiovascular events among men increase from 7 per 1,000 for ages 35-44 to 68 per 1,000 for ages 85-94.⁶ The aging of the U.S. will likely contribute to increased incidence and prevalence of heart disease and stroke.⁶

Illness and death from heart disease and stroke are also related to a number of potentially modifiable risk factors. These include medical conditions such as high blood cholesterol, diabetes mellitus, and obesity, as well as unhealthy behaviors such as cigarette smoking, sedentary lifestyle, and poor diet. High blood pressure (HTN) is

simultaneously a cardiovascular condition as well as a modifiable risk factor for heart disease and stroke, since it can be managed through effective treatment and behavior change. Multiple risk factors in the same person interact synergistically to increase the odds of a serious outcome.

High blood cholesterol: According to national estimates, self-reported prevalence of high blood cholesterol among persons screened increased from 25.7% in 1991 to 28.6% in 1999.¹¹ A 10% decrease in total cholesterol levels in the U.S. population may result in an estimated 30% reduction in the incidence of CHD.¹² While screening for cholesterol has increased in recent years, less than half of the people who qualify for any kind of lipid modifying treatment for CHD risk reduction are receiving it.¹³

Diabetes mellitus is another condition associated with CVD, particularly CHF.¹⁴ The prevalence of diabetes is increasing markedly, particularly among African Americans. Age adjusted prevalence of diabetes for U.S. Adults increased by 54% between 1994 and 2002 (from 4.8% to 7.3%).¹⁵ Prevalence of diabetes is higher among Blacks and Hispanics than for Whites, and is highest among Black females.^{16,17} Mortality from diabetes was 25.4 per 100,000 deaths in 2002.¹ Two thirds to three fourths of diabetes-related deaths are associated with some form of heart or blood vessel disorder, and heart disease death rates among adults with diabetes are 2 to 4 times higher than for those without diabetes.¹

Obesity: Nearly two-thirds (65.1%) of American adults are overweight, and 30.4% are classified as obese in 2002.¹⁸ Prevalence of obesity is higher among women (33.2% versus 27.6% for men), and particularly for African American women (49%) and Mexican American women (38.4%).¹⁸ Prevalence of obesity increased by 75% between 1991 and 2002.¹ Obesity, particularly abdominal obesity, is strongly associated with heart disease and stroke, and the obese have considerably shortened life expectancies.¹⁹⁻²¹

Cigarette smoking: Although smoking among American adults has declined by 47% since 1965, an estimated 22.5% are currently smokers.²² While prevalence for White and African American adults is similar, White adolescents are more likely than African American adolescents to smoke.²² Prevalence of smoking is higher among adults with low education and who live in poverty.²³ Smoking is a major risk factor for developing and dying from heart disease or stroke.²⁴⁻²⁶

Sedentary lifestyle: According to estimates from the National Health Interview Surveys (NHIS) from 1999-2001, 39% of the adult (18 years of age and older) U.S. population is physically inactive (i.e., reports no leisure-time physical activity).²⁷ The estimate from the 2002 Behavioral Risk Factor Surveillance System (BRFSS) was around 21% for those 18 years and older.²⁸ Prevalence of physical inactivity is higher among women compared to men, and higher among African Americans compared to Whites, being highest among African American females.^{27,28} Only 31% of U.S. adults engage in *regular* physical activity, with prevalence being higher for men and Whites.²⁷ Physical inactivity is associated with poverty and lower levels of education.²⁷ Physical inactivity is associated with increased risk of heart disease and stroke.^{29,30}

Poor diet: Less than one in four American adults adheres to the recommendation of consuming at least five servings of fruits and vegetables per day, although adherence did improve during the 1990s.³¹ According to 2002 BRFSS, the prevalence of adults who did *not* adhere to this recommendation was 75.6% for Whites and 76.5% for Blacks. Prevalence of non-adherence is also greater among men compared to women, greater among Blacks compared to Whites, and greater among younger adults.³² Annually \$33 billion in medical costs and \$9 billion in lost productivity due to heart disease, stroke, diabetes, and cancer are attributed to diet.¹

C. Overview

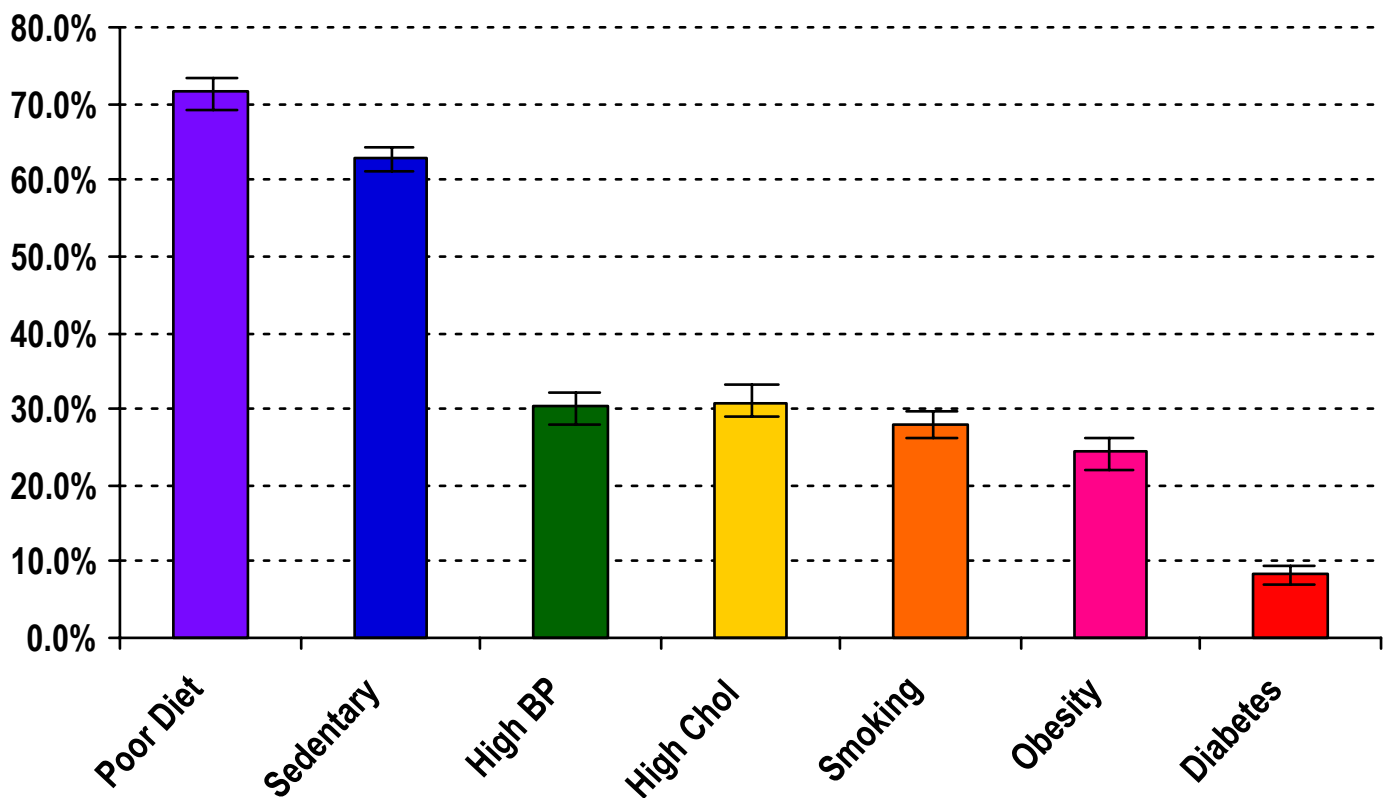
This report is organized into the following chapters. **Chapter 2** presents trends in prevalence of various modifiable risk factors for heart disease and stroke. The next three chapters report on the burden of disease occurrence and mortality in Tennessee for three main disease categories **Chapter 3:** Diseases of the Heart (overall DOH and the three subtypes of coronary heart disease (CHD), myocardial infarction (MI), and congestive heart failure (CHF)), **Chapter 4:** Stroke (overall stroke and transient ischemic attacks (TIA)), and **Chapter 5:** Hypertension (HTN). **Chapter 6** addresses the impact of diseases of the heart, stroke, and hypertension on health care utilization in Tennessee. **Chapter 7** describes the impact of these conditions on health care costs in Tennessee. Finally, **Chapter 8** discusses policy implications as well as resource and research needs. The **Appendix** includes Technical Notes (i.e., methodology) and additional detailed county-level tables.

The data presented in this report cover the period of 1996 through 2002 for the state of Tennessee and are drawn from the following data sources: **(1)** the Behavioral Risk Factor Surveillance System (**BRFSS**), 18 years and over, **(2)** the Hospital Discharge Data System (**HDDS**), all ages, **(3)** Medicare billing data for beneficiaries age 65 and over from the Centers for Medicare and Medicaid Services (**CMS**), and **(4)** the Death Statistical System Summary (**DSSS**) all ages.

II. MODIFIABLE RISK FACTORS

Major risk factors for heart disease and stroke that can be modified through behavior change and/or treatment include poor dietary habits, sedentary lifestyle, high cholesterol, cigarette smoking, obesity, and diabetes mellitus. Hypertension, or high blood pressure, is a form of heart disease, but it is also considered to be a modifiable risk factor for other forms of heart disease and stroke. Therefore, it is included here in our overall discussion of modifiable risk factors, while the detailed information on hypertension is reported in Chapter V.

According to Behavioral Risk Factor Surveillance System (BRFSS) data, among the seven modifiable risk factors examined here, poor dietary habits (less than 5 servings of fruits and vegetables a day) had the highest prevalence (71.6%) in 2002 among adults age 18 and over (See **Figure 2.1.**). The prevalence of the other risk factors was as follows: sedentary lifestyle (63.0%), high blood pressure (30.3%), high cholesterol (30.7%), cigarette smoking (27.8%), obesity (24.6%), and diabetes (8.5%). According to the United Health Foundation, in 2003 Tennessee was ranked 6th highest in the nation for prevalence of smoking and 8th highest for prevalence of obesity.



Note: 2001 data used for Sedentary Lifestyle due to change in question wording in 2002.

Figure 2.1. Prevalence of Modifiable Risk Factors in 2002, Tennessee, BRFSS

Overall, 90% of adult Tennesseans reported at least one risk factor for heart disease and stroke, and 63% reported two or more risk factors (See **Figure 2.2.**). Nearly one-third (32%) reported only one risk factor; 31% reported two risk factors; 18% reported three risk factors; 9% reported four to six risk factors; and none reported all seven risk factors. Approximately 10% reported no risk factor for heart disease and stroke.

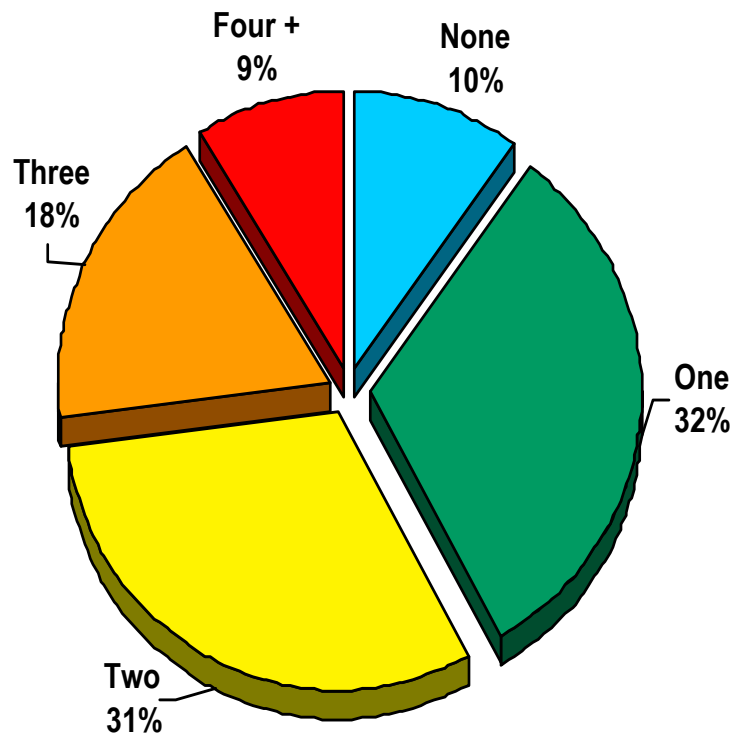


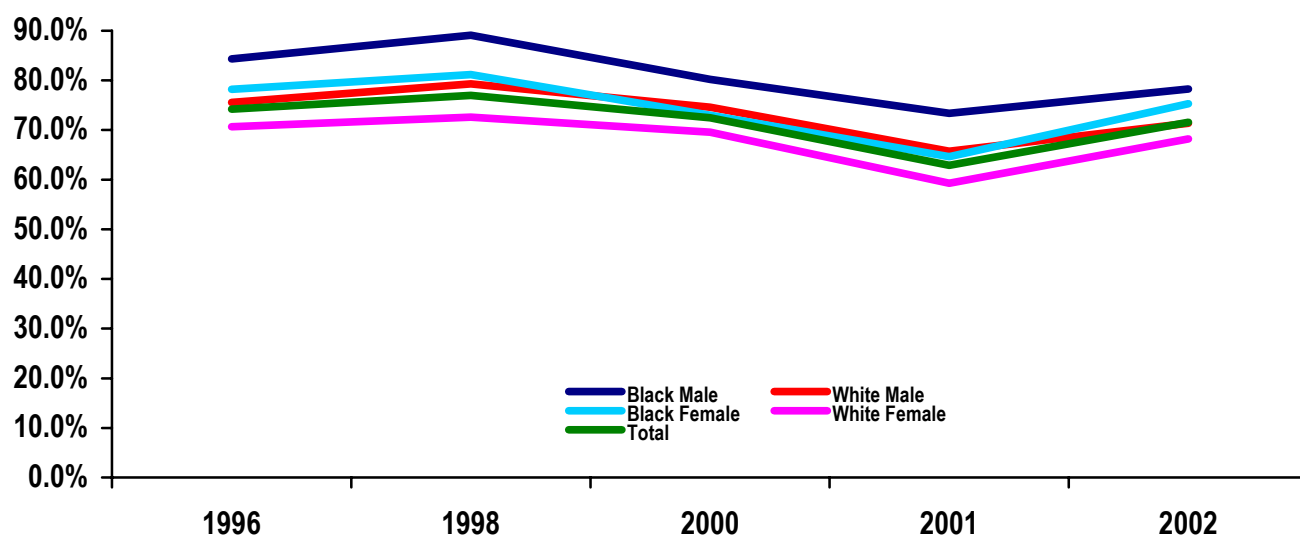
Figure 2.2. Distribution of Multiple Modifiable Risk Factors in 2002, Tennessee, BRFSS

A. Poor Dietary Habits

From 1996 to 2002, consumption of *less than five servings* of fruits and vegetables per day among Tennessee adults declined from 74.2% (1996) to 62.9% (2001), but rose again to 71.6% in 2002 (See **Table 2.1** & **Figure 2.3.**). During this time period, the prevalence of poor dietary habits varied between 73.4% and 89.1% for Black males; 65.7% and 79.3% for White males; 64.6% and 81.2% for Black females; and 62.9% and 74.2% for White females.

Table 2.1. Trends in Prevalence of Consuming Less than Five Servings of Fruits and Vegetables Per Day, Tennessee, BRFSS

	1996	1998	2000	2001	2002
Black Male	84.3%	89.1%	80.2%	73.4%	78.3%
White Male	75.6%	79.3%	74.6%	65.7%	71.4%
Black Female	78.2%	81.2%	73.0%	64.6%	75.3%
White Female	70.7%	72.6%	69.6%	59.3%	68.2%
Total	74.2%	77.0%	72.5%	62.9%	71.6%



Note: Questions regarding fruit and vegetable consumption were not asked in 1997 & 1999.

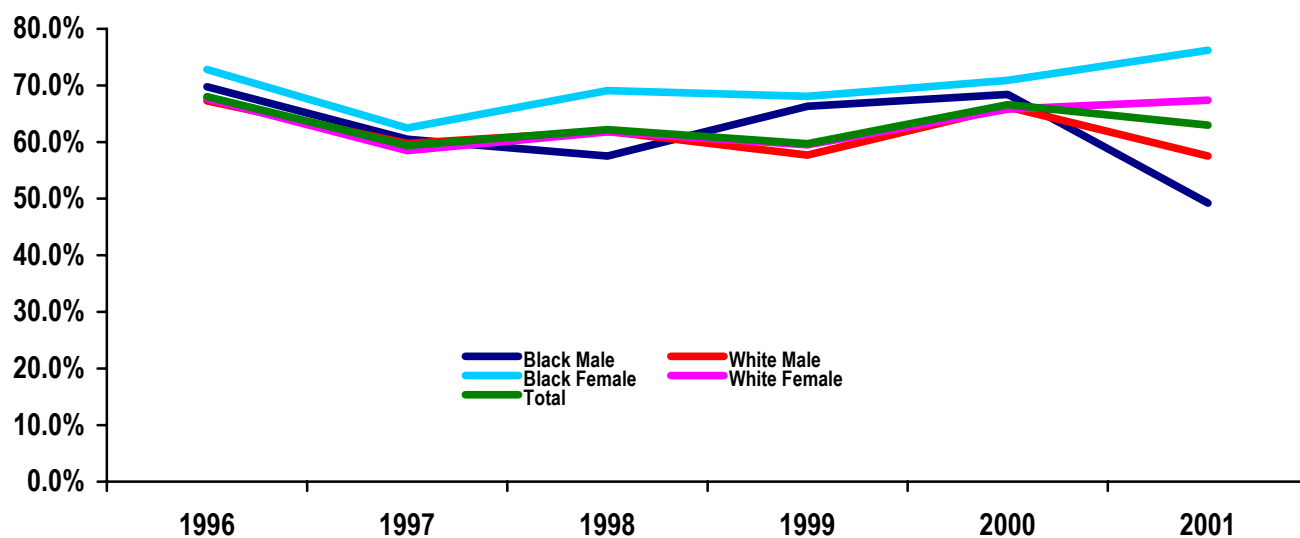
Figure 2.3. Trends in Prevalence of Consuming Less than Five Servings of Fruits and Vegetables Per Day, Tennessee, BRFSS

B. Sedentary Lifestyle

The total prevalence of adult Tennesseans with a sedentary lifestyle decreased slightly from 68.0% in 1996 to 63.0% in 2001 (See **Table 2.2** & **Figure 2.4**). Over this time period, Black males showed the greatest improvement with a decrease in sedentary lifestyle from 69.8% to 49.2%, while Black females had an increase in sedentary lifestyle from 72.8% to 76.2%. White males also had a substantial decrease in sedentary life from 67.3% to 57.5%, while the proportion of White females at risk remained very stable, ranging from 67.7% to 67.4%.

Table 2.2. Trends in Prevalence of Sedentary Lifestyle, 1996-2001, Tennessee, BRFSS

	1996	1997	1998	1999	2000	2001
Black Male	69.8%	60.5%	57.5%	66.3%	68.4%	49.2%
White Male	67.3%	59.8%	61.9%	57.7%	66.2%	57.5%
Black Female	72.8%	62.5%	69.1%	68.1%	70.9%	76.2%
White Female	67.7%	58.5%	61.8%	59.5%	65.8%	67.4%
Total	68.0%	59.4%	62.2%	59.7%	66.6%	63.0%



Note: 2002 not reported due to change in question wording

Figure 2.4. Trends in Prevalence of Sedentary Lifestyle, 1996-2001, Tennessee, BRFSS

C. High Cholesterol

The percentage of Tennessee adults who had been told by a doctor that they had high cholesterol stayed fairly stable in recent years, with 31.1% in 1996 and 30.7% in 2002 (See **Table 2.3 & Figure 2.5.**). The prevalence of high cholesterol among White males showed an overall increase from 27.6% in 1996 to 31.4% in 2002, while the prevalence for Black females decreased from 33.5% to 22.5%. The prevalence for Black males and for White females both fluctuated across the years but did not exhibit an overall trend up or down, with variation between 14.5% and 27.9% for Black males and between 20.7% and 34.4% for White females.

Table 2.3. Trends in Prevalence of High Blood Cholesterol, 1996-2002, Tennessee, BRFSS

	1996	1997	1998	1999	2000	2001	2002
Black Male	26.0%	24.3%	14.5%	20.4%	31.8%	24.9%	27.9%
White Male	27.6%	25.9%	27.5%	29.6%	30.7%	37.8%	31.4%
Black Female	33.5%	27.0%	23.2%	32.2%	29.2%	21.4%	22.5%
White Female	34.3%	33.2%	30.3%	20.7%	30.9%	32.4%	31.9%
Total	31.1%	29.4%	27.5%	29.1%	30.7%	33.2%	30.7%

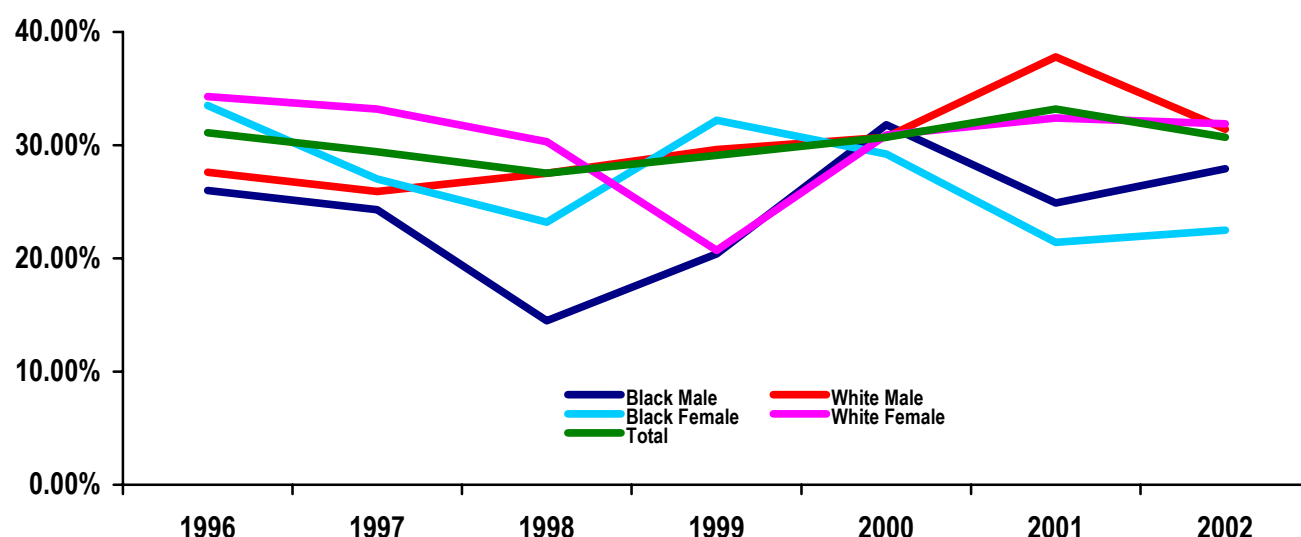


Figure 2.5. Trends in Prevalence of High Blood Cholesterol, 1996-2002, Tennessee, BRFSS

D. Cigarette Smoking

The prevalence of current cigarette smoking (smoked at least 100 cigarettes in lifetime and currently smoke every day or some days of the week) in the total Tennessee adult population remained fairly stable, ranging between 24.4% and 28.0% during the period of 1996 to 2002. (See **Table 2.4 & Figure 2.6.**). The prevalence of current cigarette smoking for White males, White females, and Black males all hovered around the total prevalence during this time period. However, Black females reported consistently lower prevalence of cigarette smoking than the other groups, at 20.1% in 2002.

Table 2.4. Trends in Prevalence of Current Cigarette Smoking, 1996-2002, Tennessee, BRFSS

	1996	1997	1998	1999	2000	2001	2002
Black Male	24.4%	24.9%	43.9%	26.2%	28.0%	31.3%	23.9%
White Male	31.6%	28.4%	28.0%	24.9%	28.2%	25.4%	28.5%
Black Female	17.9%	16.8%	20.6%	18.8%	13.7%	13.3%	20.1%
White Female	26.4%	28.0%	22.9%	25.1%	25.8%	24.8%	25.3%
Total	28.0%	26.9%	26.0%	24.8%	25.7%	24.4%	27.8%

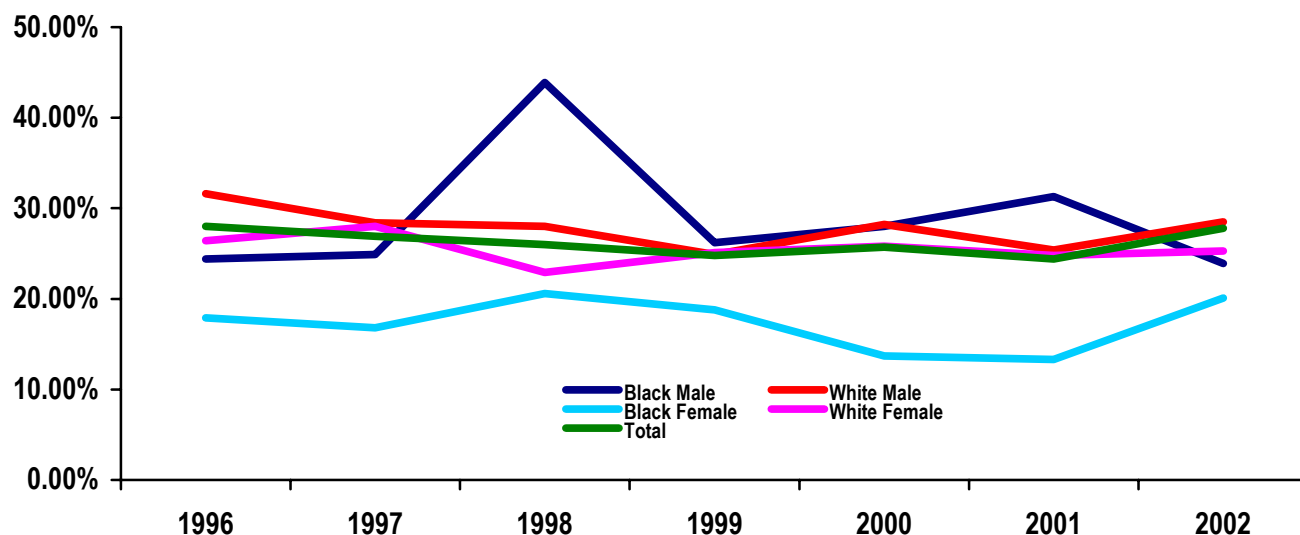


Figure 2.6. Trends in Prevalence of Current Cigarette Smoking, 1996-2002, Tennessee, BRFSS

E. Obesity

The overall prevalence of obesity (BMI = 30 or higher) in the Tennessee adult population increased steadily from 17.4% in 1996 to 24.6% in 2002 (see **Table 2.5 & Figure 2.7**). Black females consistently had the highest prevalence of obesity, increasing from 27.8% in 1996 to 35.8% in 2002. Black males exhibited the largest increase in obesity prevalence during this time period, from 21.1% in 1996 to 35.9% in 2002. White males and White females had slower rates of increase, from 17.3% to 22.4% for males and 17.3% to 21.4% for females.

Table 2.5. Trends in Prevalence of Obesity, 1996-2002, Tennessee, BRFSS

	1996	1997	1998	1999	2000	2001	2002
Black Male	21.1%	25.9%	18.4%	15.4%	26.9%	20.8%	35.9%
White Male	17.3%	16.7%	19.7%	21.9%	22.4%	25.1%	22.4%
Black Female	27.8%	30.9%	30.9%	31.1%	39.6%	32.1%	35.8%
White Female	17.3%	17.0%	18.4%	20.6%	19.9%	21.4%	21.4%
Total	17.4%	17.7%	19.2%	20.5%	22.9%	23.4%	24.6%

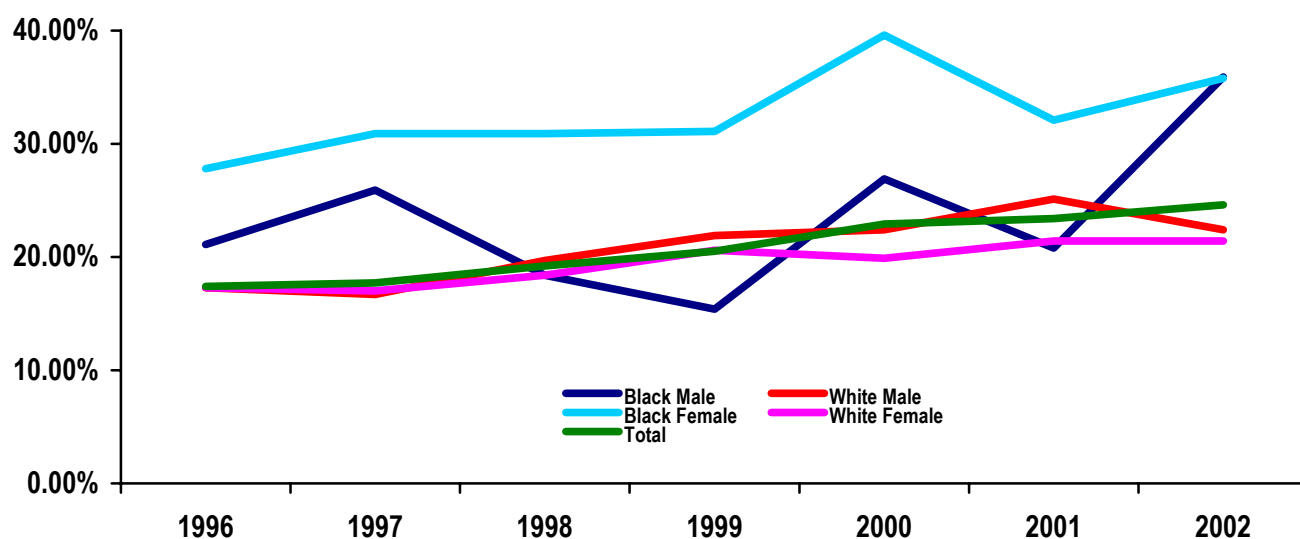


Figure 2.7. Trends in Prevalence of Obesity, 1996-2002, Tennessee, BRFSS

F. Diabetes Mellitus

Trends in prevalence of diabetes mellitus (respondent told by a doctor that s/he has diabetes mellitus) among Tennessee adults showed a steady increase from a low of 4.4% in 1997 to a high of 8.5% in 2002 (See **Table 2.6** & **Figure 2.8**). Black Females had the highest prevalence in most years, which increased from 9.1% in 1996 to 12.4% in 2002. Black Males had the largest overall increase from 3.4% in 1996 to 13.0% in 2002. Both White Males and Females steadily increased from 1996 to 2002 near the prevalence for the total adult population, from 4.3% to 7.8% and 5.2% to 7.8%, respectively.

Table 2.6. Trends in Prevalence of Diabetes Mellitus, 1996-2002, Tennessee, BRFSS

	1996	1997	1998	1999	2000	2001	2002
Black Male	3.4%	3.1%	8.0%	6.4%	2.8%	7.5%	13.0%
White Male	4.3%	3.5%	5.2%	5.9%	7.6%	7.9%	7.8%
Black Female	9.1%	6.0%	8.7%	11.3%	14.8%	10.1%	12.4%
White Female	5.2%	4.9%	6.1%	5.3%	6.5%	7.3%	7.8%
Total	5.0%	4.4%	5.9%	6%	7.2%	7.7%	8.5%

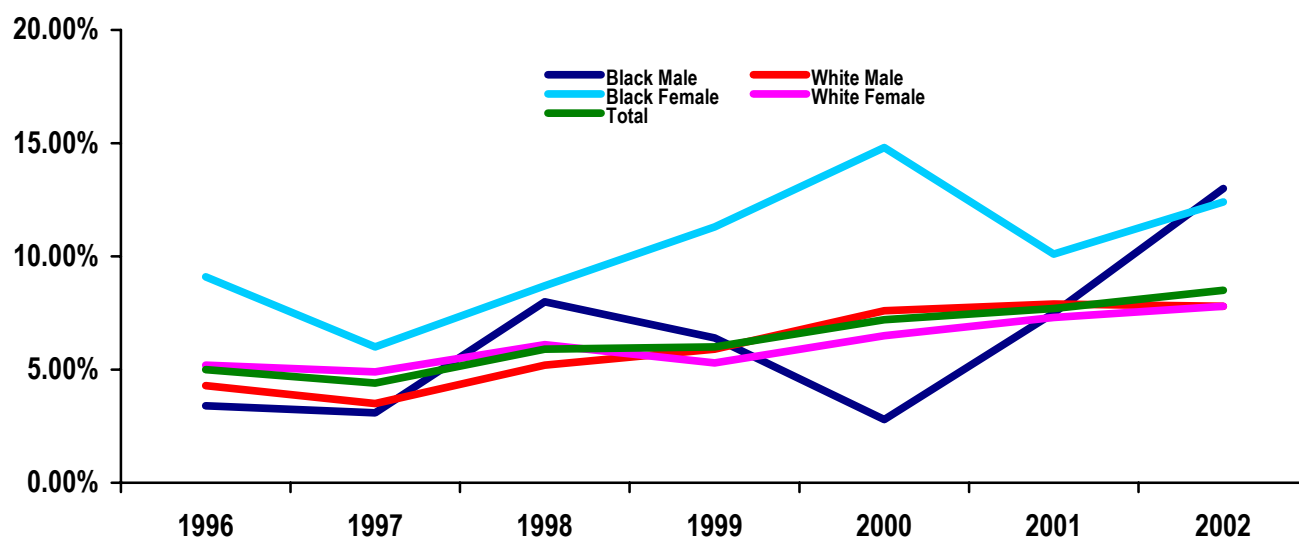


Figure 2.8. Trends in Prevalence of Diabetes Mellitus, 1996-2002, Tennessee, BRFSS

III. DISEASES OF THE HEART

(ICD-9-CM: 390 – 398, 402, 404 - 429) (ICD-10: I00 – I09, I11, I20 – I51)

A. Diseases of the Heart (Overall)

Tables 3.1.- 3.5. report the frequency and age-adjusted rates of diseases of the heart (DOH) as a primary diagnosis from several data sources: inpatient files from HDDS (all ages) and CMS (age 65 and over), outpatient files from HDDS and CMS, and carrier (physician) files from CMS (See Technical Notes in Appendix A). The tables report data for the state of Tennessee for the total sample (including all races), by race, by gender, and by race-gender groups, covering the period of 1997-2002 for HDDS and 1996-2002 for CMS. The trends for HDDS inpatient data and CMS inpatient data are also illustrated in **Figures 3.1.** and **3.2.**

According to the HDDS data, the number of inpatients in Tennessee with a primary diagnosis of DOH increased by 13% from 61,803 in 1997 to 69,628 in 2002 (See **Table 3.1.**). However, the age-adjusted rates only increased by 4% from 1,140.7 to 1,189.5 per 100,000 population during this time period (See **Figure 3.1.**). This suggests that most of the raw increase in inpatients seen for DOH was due to an aging population.

The age-adjusted rates of DOH among inpatients were consistently higher for men compared to women, and higher for Blacks compared to Whites across the years. Black men had the highest overall age-adjusted rate of DOH (1,444.4/100,000 in 2002), but were similar to White men between 1999-2001, and their rate decreased by 11% from 1997 to 2002. White men and Black women had similar age-adjusted rates of DOH (1,331.7/100,000 and 1,307.6/100,000, respectively, in 2002), although the rates for White men tended to be slightly higher, given that the rates for Black women decreased by 3% from 1997 to 2002. White women consistently had the lowest rate (900.4/100,000 in 2002), although it increased by 7% from 1997 to 2002.

Table 3.1. Frequency and Age-adjusted Rate of Diseases of the Heart, 1997-2002, Tennessee, HDDS Inpatient Files

Group	1997	1998	1999	2000	2001	2002
Frequencies						
White Male	26,701	26,940	28,321	28,461	28,708	29,618
White Female	23,180	23,500	24,290	25,389	25,682	26,471
Black Male	4,251	4,777	3,661	3,639	3,719	4,201
Black Female	5,152	5,533	4,942	4,517	4,644	5,379
Total White	49,891	50,465	52,629	53,855	54,390	56,089
Total Black	9,404	10,320	8,605	8,157	8,363	9,580
Total Male	32,300	34,087	33,954	34,869	35,569	36,023
Total Female	29,503	30,830	30,770	32,120	33,005	33,605
Total	61,803	64,954	64,745	66,995	68,574	69,628
Age-adjusted Rate Per 100,000						
White Male	1,304.7	1,296.3	1,332.4	1,325.7	1,311.7	1,331.7
White Female	838.4	835.7	853.0	884.8	884.3	900.4
Black Male	1,623.0	1,796.4	1,337.5	1,311.2	1,315.8	1,444.4
Black Female	1,348.1	1,422.3	1,256.8	1,137.5	1,158.7	1,307.6
Total White	1,050.5	1,043.8	1,071.0	1,084.6	1,079.5	1,096.0
Total Black	1,465.2	1,582.8	1,294.4	1,214.2	1,220.8	1,369.8
Total Male	1,390.0	1,439.0	1,405.9	1,428.8	1,431.1	1,422.1
Total Female	936.2	963.1	948.1	980.2	994.4	999.0
Total	1,140.7	1,176.9	1,154.6	1,181.6	1,191.2	1,189.5

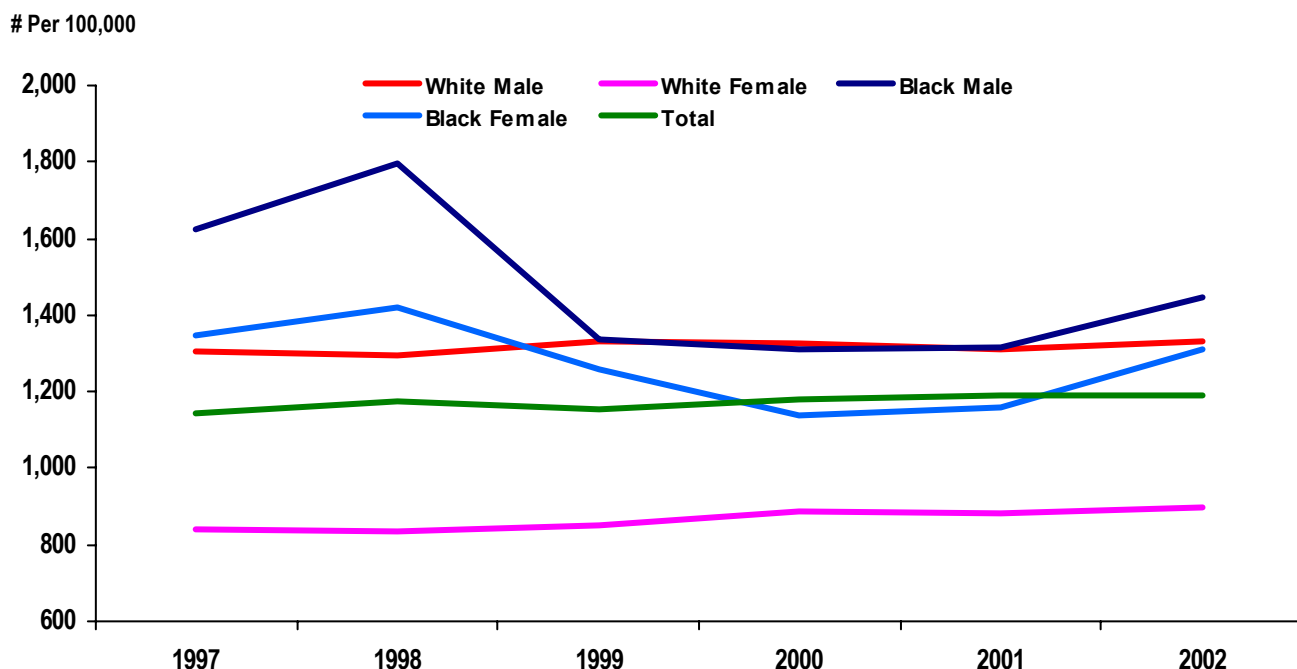


Figure 3.1. Trends in Age-adjusted Rate of Diseases of the Heart, 1997-2002, Tennessee, HDDS Inpatient Files

According to CMS data, the number of inpatients age 65 and over in Tennessee with a primary diagnosis of DOH increased by 3% from 39,209 in 1996 to 40,288 in 2002 (See **Table 3.2.**). The age-adjusted rates of DOH among inpatients were nearly five times higher for the 65 and over population (CMS) compared to the general population (HDDS). In most of the CMS results, a data anomaly in 1997 is noticed, with unusually low rates for that year for given diagnoses (See **Figure 3.2.**). Overall, the age-adjusted rates of DOH among elderly inpatients decreased by 2% from 5,540.9 per 100,000 to 5,405.6 per 100,000 population from 1996 to 2002. This suggests that most of the raw increase in inpatients seen for DOH was due to an aging population.

The age-adjusted rates of DOH among inpatients age 65 and over were consistently higher for men compared to women. For most years, the rate of DOH was higher for Blacks compared to Whites, given that the rate for Blacks increased by 11% compared to a 4% decrease among Whites from 1996 to 2002. The increase in DOH among elderly Black inpatients was mostly driven by the 13% increase among Black females (5,337.5 to 6,036.0/100,000). In fact, by 2002, the DOH rate for Black females approached the rate for White men, who had the highest rate (6,142.1/100,000 in 2002). Black males had the next highest rate (5,499.3/100,000 in 2002), followed by White women with the lowest rate (4,845.7/100,000).

Table 3.2. Frequency and Age-adjusted Rate of Diseases of the Heart, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	15,660	10,919	15,629	15,542	16,088	15,338	16,090
White Female	18,982	13,141	18,484	18,494	19,271	18,698	19,515
Black Male	1,473	851	1,486	1,441	1,527	1,424	1,539
Black Female	2,575	1,573	2,619	2,749	2,645	2,569	2,915
Total White	34,642	24,060	34,113	34,036	35,359	34,036	35,605
Total Black	4,048	2,424	4,105	4,190	4,172	3,993	4,454
Total Male	17,347	11,868	17,268	17,151	17,703	16,842	17,719
Total Female	21,862	14,889	21,375	21,501	22,116	21,387	22,569
Total	39,209	26,757	38,643	38,652	39,819	38,229	40,288

Table 3.2. Continued

GROUP	1996	1997	1998	1999	2000	2001	2002
Age-adjusted Rate Per 100,000							
White Male	6,487.4	4,516.5	6,303.1	6,162.0	6,269.5	5,889.1	6,142.1
White Female	4,994.4	3,398.0	4,737.7	4,702.0	4,817.9	4,653.5	4,845.6
Black Male	5,280.2	3,069.2	5,343.1	5,236.8	5,490.0	5,191.2	5,499.3
Black Female	5,337.5	3,229.3	5,408.2	5,718.0	5,402.5	5,296.9	6,036.0
Total White	5,595.2	3,837.1	5,358.4	5,291.4	5,384.7	5,158.2	5,367.5
Total Black	5,302.7	3,164.7	5,389.3	5,530.3	5,428.2	5,237.4	5,859.9
Total Male	6,650.1	4,550.8	6,491.4	6,354.4	6,513.2	6,113.1	6,362.1
Total Female	5,292.2	3,552.6	5,056.6	5,057.8	5,172.4	4,957.9	5,180.3
Total	5,540.9	3,752.7	5,345.4	5,297.3	5,398.8	5,154.8	5,405.5

Per 100,000

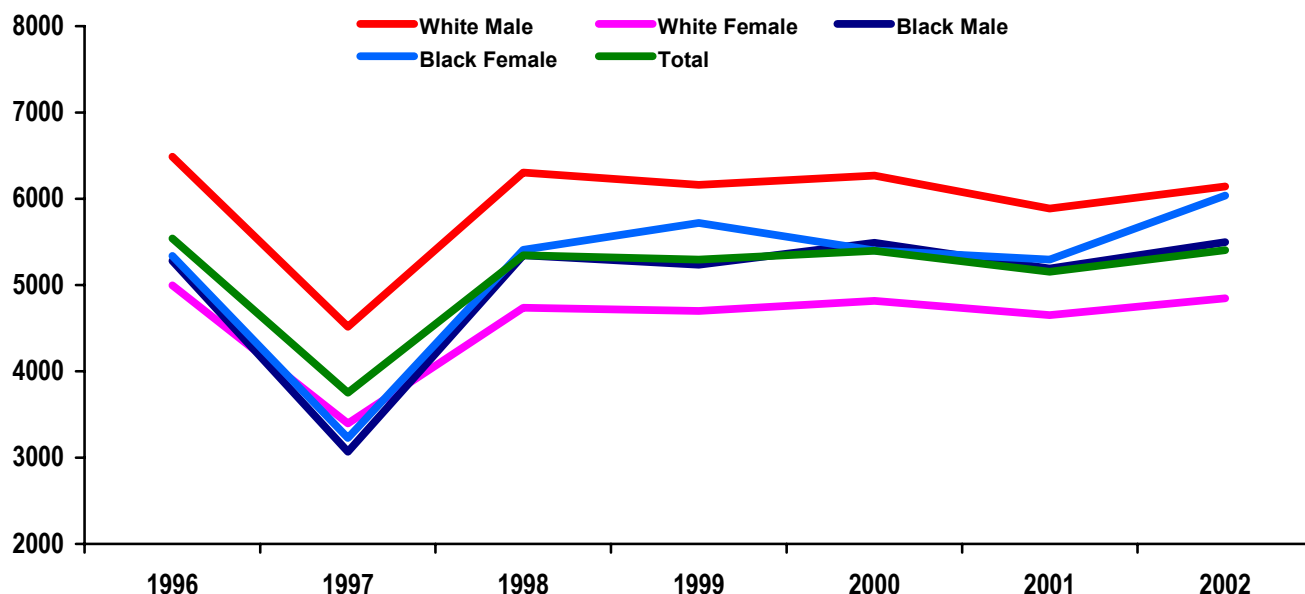


Figure 3.2. Trends in Age-adjusted Rate of Diseases of the Heart, 1996-2002, Tennessee, CMS Inpatient Files

According to the HDDS data, the number of outpatients in Tennessee with a primary diagnosis of DOH increased by 79% from 25,929 in 1997 to 46,296 in 2002 (See **Table 3.3.**). However, the age-adjusted rates also increased by 64% from 474.6 to 780.1 per 100,000 population during this time period. This suggests that the raw increase in outpatients seen for DOH was not merely due to an aging population.

The age-adjusted rates of DOH among outpatients were consistently higher for men compared to women. In 1997 the outpatient DOH rate was higher for Blacks compared to Whites. However, the White rate increased by 73% compared to a 28% increase for Blacks, such that Whites had a higher rate in 2002. These same patterns persist when comparing White men and Black men, but White women do not surpass Black women by 2002. White men had the highest age-adjusted rate of DOH as outpatients in 2002 (923.4/100,000), and Black men had the second highest (803.4/100,000), followed by Black women (660.0/100,000) and White women (606.2/100,000).

Table 3.3. Frequency and Age-adjusted Rate of Diseases of the Heart, 1997-2002, Tennessee, HDDS Outpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Frequencies						
White Male	11,299	14,316	14,678	18,785	19,662	21,571
White Female	9,346	11,765	12,149	15,360	15,655	16,967
Black Male	1,750	2,216	1,824	2,064	2,012	2,501
Black Female	1,996	2,509	2,193	2,439	2,410	2,838
Total White	20,646	26,087	26,831	34,147	35,317	38,538
Total Black	3,746	4,725	4,018	4,504	4,422	5,339
Total Male	13,877	17,482	17,399	22,476	23,528	25,544
Total Female	12,050	15,035	15,057	18,973	19,346	20,752
Total	25,929	32,523	32,462	41,452	42,874	46,296
Age-adjusted Rate Per 100,000						
White Male	532.6	663.4	662.2	833.4	855.8	923.4
White Female	352.4	437.3	446.2	560.6	565.4	606.2
Black Male	637.8	785.9	628.2	689.3	656.8	803.4
Black Female	508.4	625.1	542.1	593.7	577.6	660.0
Total White	434.1	539.2	545.2	685.7	698.5	750.2
Total Black	560.5	690.6	577.9	632.4	608.3	714.5
Total Male	575.3	709.9	688.0	873.3	895.2	956.3
Total Female	393.5	483.5	477.9	597.8	601.5	637.2
Total	474.6	584.3	573.1	721.9	734.7	780.1

According to CMS data, the number of outpatients age 65 and over in Tennessee with a primary diagnosis of DOH increased by 18% from 62,836 in 1996 to 74,256 in 2002 (See **Table 3.4.**). (Note: The number of DOH cases in the CMS outpatient data is greater than in the HDDS outpatient data because not all facilities report to HDDS [e.g., VA facilities, non-hospital-affiliated outpatient clinics], while they all bill to CMS). The age-adjusted rates of DOH among outpatients were much higher for the 65 and over population (CMS) compared to the general population (HDDS). Overall, the age-adjusted rates of DOH among elderly outpatients increased by 11% from 8,915.5 per 100,000 to 9,935.8 per 100,000 population from 1996 to 2002. This suggests that most of the raw increase in outpatients seen for DOH was due to an aging population.

The age-adjusted rates of DOH among outpatients age 65 and over were consistently higher for men compared to women, and higher for Whites compared to Blacks. In 2002, among the elderly population, White males had the highest age-adjusted rate of DOH as outpatients (11,623.1/100,000), followed by White females (9,137.2/100,000), Black females (8,198.4/100,000), and Black males with the lowest rate (7,715.8/100,000).

Table 3.4. Frequency and Age-adjusted Rate of Diseases of the Heart, 1996-2002, Tennessee, CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	24,134	25,802	30,233	29,469	30,083	30,720	30,936
White Female	32,480	37,618	38,971	37,470	37,769	37,761	36,792
Black Male	1,800	2,213	2,133	2,105	2,119	2,126	2,141
Black Female	3,557	4,108	4,018	4,035	4,158	4,032	3,968
Total White	56,614	63,420	69,204	66,939	67,852	68,481	67,728
Total Black	5,357	6,321	6,151	6,140	6,277	6,158	6,109
Total Male	26,261	28,253	32,654	31,870	32,363	32,994	33,258
Total Female	36,575	42,327	43,516	42,021	42,210	42,038	40,998
Total	62,836	70,580	76,170	73,891	74,573	75,032	74,256

Table 3.4. Continued

GROUP	1996	1997	1998	1999	2000	2001	2002
Age-adjusted Rate Per 100,000							
White Male	10,067.3	9,945.7	12,186.3	11,695.2	11,633.2	11,712.7	11,623.1
White Female	8,537.4	9,673.3	9,969.9	9,508.6	9,434.3	9,389.0	9,137.2
Black Male	6,555.0	7,682.5	7,745.9	7,677.3	7,667.7	7,673.9	7,715.8
Black Female	7,340.3	8,464.3	8,258.0	8,342.6	8,504.6	8,324.5	8,198.4
Total White	9,184.9	9,777.3	10,900.0	10,419.1	10,322.6	10,361.1	10,176.2
Total Black	7,039.9	8,170.3	8,077.2	8,094.9	8,184.5	8,070.0	8,015.8
Total Male	10,123.5	10,282.2	12,276.9	11,806.3	11,839.6	11,902.8	11,820.2
Total Female	8,833.3	10,196.4	10,261.9	9,864.8	9,869.1	9,743.0	9,422.2
Total	8,915.5	9,595.3	10,561.6	10,137.1	10,103.8	10,101.2	9,935.8

According to CMS carrier (physician) data, the number of patients age 65 and over in Tennessee who were seen by a physician with a primary diagnosis of DOH increased by 8% from 221,384 in 1996 to 239,169 in 2002 (See **Table 3.5**). Overall, the age-adjusted rates of physician-diagnosed DOH among elderly patients increased by 2% from 31,296.3 per 100,000 to 31,978.1 per 100,000 population from 1996 to 2002. This suggests that some of the raw increase in patients seen for DOH was due to an aging population.

The age-adjusted rates of physician-diagnosed DOH among the age 65 and over population were consistently higher for men compared to women, and higher for Whites compared to Blacks. In 2002, among the elderly population, White males had the highest age-adjusted rate of physician-diagnosed DOH (36,052.6/100,000), followed by Black males (30,404.2/100,000), White females (29,699.1/100,000), and Black females with the lowest rate (27,955.1/100,000).

Table 3.5. Frequency and Age-adjusted Rate of Diseases of the Heart, 1996-2002, Tennessee, CMS Carrier Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	83,542	88,763	89,986	89,581	91,177	94,249	95,941
White Female	112,547	118,739	117,819	115,864	116,713	118,779	119,430
Black Male	7,445	7,972	7,879	7,448	7,646	7,717	7,744
Black Female	14,769	15,842	15,394	14,871	14,892	14,739	14,706
Total White	196,089	207,502	207,805	205,445	207,890	213,028	215,371
Total Black	22,214	23,814	23,273	22,319	22,538	22,456	22,450
Total Male	92,147	97,516	98,786	97,959	99,338	102,500	104,248
Total Female	129,237	136,076	135,006	132,517	132,494	134,340	134,921
Total	221,384	233,592	233,792	230,476	231,832	236,840	239,169
Age-adjusted Rate Per 100,000							
White Male	34,688.6	36,020.3	35,990.0	35,383.3	35,183.8	35,911.7	36,052.6
White Female	29,572.7	30,658.7	30,173.2	29,449.6	29,195.8	29,579.9	29,699.1
Black Male	26,975.8	28,703.9	28,574.7	27,153.7	27,555.3	27,819.8	27,955.1
Black Female	30,541.9	32,607.8	31,746.0	30,719.5	30,409.1	30,305.8	30,404.2
Total White	31,669.7	32,861.4	32,555.9	31,871.3	31,563.5	32,172.0	32,322.4
Total Black	29,203.5	31,162.7	30,575.1	29,419.5	29,365.6	29,402.7	29,522.3
Total Male	35,398.5	36,895.7	36,945.9	36,179.6	36,286.3	36,953.5	37,061.8
Total Female	31,272.7	32,527.6	31,961.8	31,208.1	31,057.8	31,219.8	31,077.6
Total	31,296.3	32,565.3	32,271.4	31,532.4	31,356.2	31,838.3	31,978.1

Figure 3.3. is a map of the age-adjusted rates of DOH by county, based on HDDS data (five-year average, 1998-2002). The darker portions of the map reflect higher age-adjusted rates of DOH. The ten counties with the lowest age-adjusted rates of DOH in Tennessee were Moore, Lincoln, Anderson, Sequatchie, Union, Fayette, Johnson, Jackson, Hardin, and Sullivan (ranging from 496.4 to 981.5/100,000). The ten counties with the highest age-adjusted rates of DOH were Fentress, Lauderdale, Scott, Morgan, Claiborne, Tipton, Grundy, Perry, Campbell, and Smith (ranging from 1,548.7/100,000 in Smith to 2,162.3/100,000 in Fentress).

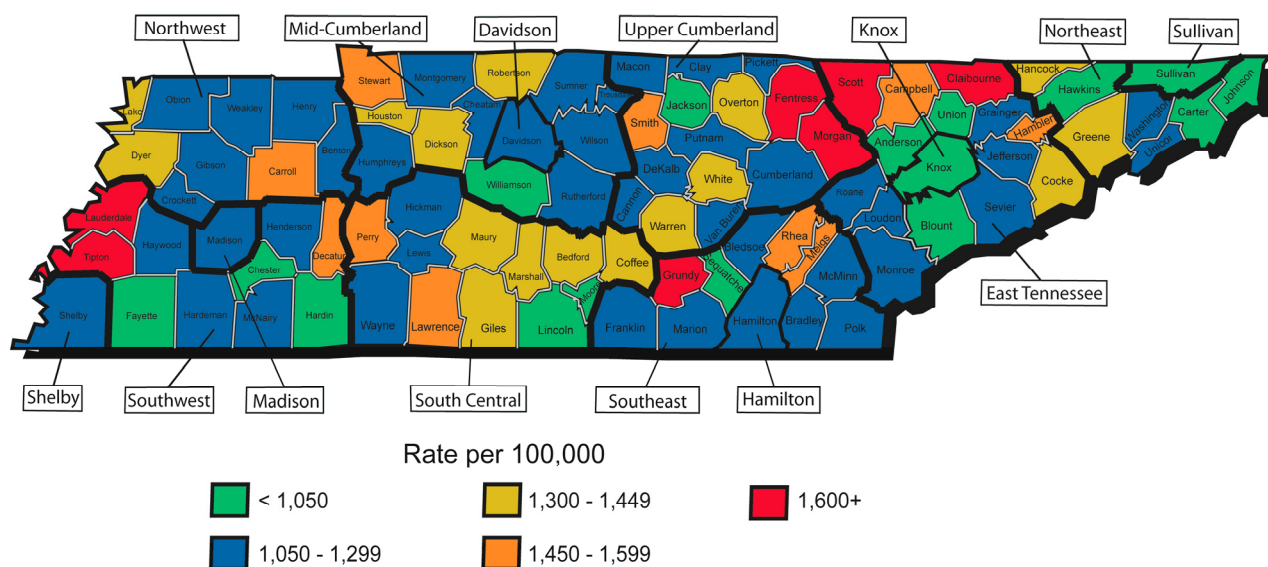


Figure 3.3. Average Age-adjusted Rate of Diseases of the Heart by County and Health Service Region, 1998-2002, Tennessee, HDDS Inpatient Files

Figure 3.4. is a map of the age-adjusted rates of DOH by county for the age 65 and over population, based on CMS data (five-year average, 1998-2002). Again, the darker portions of the map reflect higher age-adjusted rates of DOH. The ten counties with the lowest age-adjusted rates of DOH among the elderly in Tennessee were Sullivan, Moore, Anderson, Davidson, Sequatchie, Sumner, Union, Hawkins, Fayette, and Rutherford (ranging from 4,090.2 to 4,801.8/100,000). Six of these were also among the lowest counties in the HDDS inpatient data. The ten counties with the highest age-adjusted rates of DOH among the elderly were Fentress, Lake, Crockett, Scott, Lauderdale, Hancock, Perry, Claiborne, Clay, and Houston (ranging from 7,955.6/100,000 in Houston to 11,251.8/100,000 in Fentress). Five of these were also among the highest counties in the HDDS inpatient data.

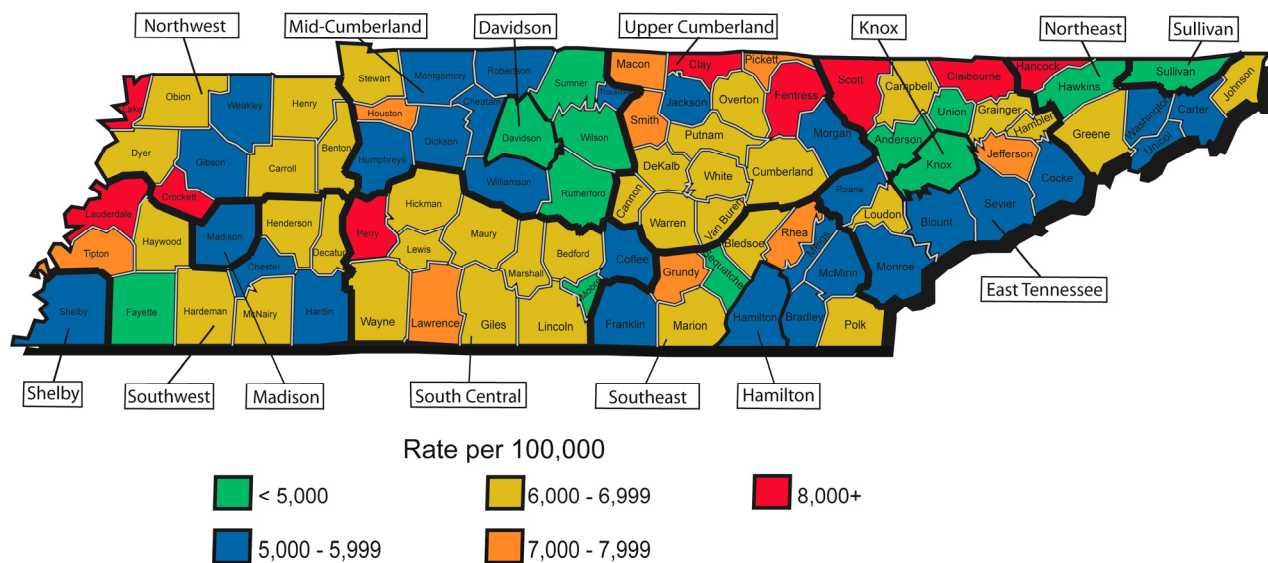


Figure 3.4. Average Age-adjusted Rate of Diseases of the Heart by County and Health Service Region, 1998-2002, Tennessee, CMS Inpatient Files

Table 3.6. and **Figures 3.5.-3.9.** present the prevalence of major co-morbid conditions that may co-occur with DOH (i.e., hypertension (HTN), high cholesterol (HCL), and diabetes mellitus (DM)) based on the HDDS and CMS data sets. In the HDDS inpatient file for the total population, only one in five individuals with a primary diagnosis of DOH does not also have a diagnosis for HTN, HCL, or DM (See **Figure 3.5.**). More than two-thirds of inpatients with DOH also have a diagnosis of HTN, one-third also has a diagnosis of DM, and almost one-third

also has a diagnosis of HCL. About one-third of inpatients with DOH have two of these co-morbid conditions, and one-tenth has all three of these co-morbid conditions.

Less co-morbid diagnoses show up in the HDDS outpatient file for the total population, since almost two in five individuals with DOH as a primary diagnosis do not have a co-morbid diagnosis of HTN, HCL, or DM (See **Figure 3.6.**). Just over half of outpatients with DOH also have a diagnosis of HTN, one-fifth also has a diagnosis of DM, and almost one-quarter also has a diagnosis of high cholesterol. About one-fourth of outpatients with DOH have two of these co-morbid conditions, and 6% has all three of these co-morbid conditions.

The pattern of co-morbidity with DOH for the age 65 and over population in the CMS inpatient file is similar to that of the total population in the HDDS inpatient file (See **Figure 3.7.**). The main difference is that the levels of DOH with HTN only and HTN/DM are slightly higher in the CMS inpatient file. The pattern of co-morbidity for the age 65 and over population in the CMS outpatient file is similar to that of the total population in the HDDS outpatient file (See **Figure 3.8.**), with slightly higher levels of HTN only and HTN/HCL in the CMS inpatient file.

The CMS carrier file represents the morbidity patterns of the general age 65 and over population, since the vast majority of Medicare beneficiaries are seen by a physician at least once a year. In the CMS carrier file, 18.6% of individuals with a primary diagnosis of DOH do not also have a diagnosis for HTN, HCL, or DM (See **Figure 3.9.**). More than two-thirds of patients with DOH also have a diagnosis of HTN, one-quarter also has a diagnosis of DM, and 42.9% also has a diagnosis of high cholesterol. One-third of inpatients with DOH have two of these co-morbid conditions, and one-tenth has all three of these co-morbid conditions. The main difference between the CMS carrier file and the other files is that there are higher levels of diagnosed cholesterol and lower levels of diagnosed diabetes among patients with DOH compared to the inpatient and outpatient files.

Notably, the pattern of co-morbidity with DOH differs by race in a fairly consistent pattern across inpatient, outpatient and carrier files for both the total population and the 65 and over population. In general Black patients with DOH are more likely than White patients to have co-morbid HTN only and HTN/DM, and they are less likely to have co-morbid HCL only and HTN/HCL.

Table 3.6. Co-morbidity of Diseases of the Heart with Hypertension, Diabetes and Hypercholesterolemia, 2002, Tennessee

CO-MORBID CONDITION(S)	HDDS Inpatient	HDDS Outpatient	CMS Inpatient	CMS Outpatient	CMS Carrier
Total					
No Co-morbid Conditions	20.7%	38.7%	18.5%	30.9%	18.6%
Hypertension (HTN) Only	27.3%	22.8%	31.2%	24.4%	26.9%
Diabetes (DM) Only	4.8%	4.2%	4.9%	4.6%	3.0%
High Cholesterol (HCL) Only	5.1%	4.5%	3.6%	6.9%	7.6%
HTN & DM	15.9%	10.4%	17.5%	10.0%	8.6%
HTN & HCL	14.6%	12.3%	13.9%	14.4%	22.9%
DM & HCL	1.6%	1.2%	1.2%	1.6%	1.8%
HTN & DM & HCL	10.0%	6.0%	9.2%	7.3%	10.6%
Total Whites					
No Co-morbid Conditions	21.5%	38.4%	19.6%	31.6%	19.2%
HTN Only	26.2%	22.5%	30.7%	24.1%	26.2%
DM Only	4.9%	4.2%	5.1%	4.6%	3.0%
HCL Only	5.6%	4.9%	3.9%	7.3%	8.2%
HTN & DM	14.3%	9.7%	15.8%	9.3%	7.5%
HTN & HCL	15.7%	13.1%	14.6%	14.6%	23.7%
DM & HCL	1.8%	1.3%	1.3%	1.6%	2.0%
HTN & DM & HCL	10.1%	6.1%	9.0%	7.0%	10.3%

Table 3.6. Continued

CO-MORBID CONDITION(S)	HDDS Inpatient	HDDS Outpatient	CMS Inpatient	CMS Outpatient	CMS Carrier
Total Blacks					
No Co-morbid Conditions	13.9%	37.6%	9.4%	22.6%	13.2%
HTN Only	33.9%	25.9%	35.0%	28.1%	32.4%
DM Only	3.5%	3.8%	3.6%	4.7%	3.0%
HCL Only	1.5%	1.5%	1.0%	2.7%	1.9%
HTN & DM	26.3%	17.2%	30.9%	18.1%	18.7%
HTN & HCL	9.4%	7.4%	9.1%	12.7%	16.4%
DM & HCL	0.8%	0.6%	.6%	.9%	.8%
HTN & DM & HCL	10.7%	6.0%	10.4%	10.2%	13.6%
No Co-morbid Conditions	100.0%	37.6%	9.4%	22.6%	13.2%

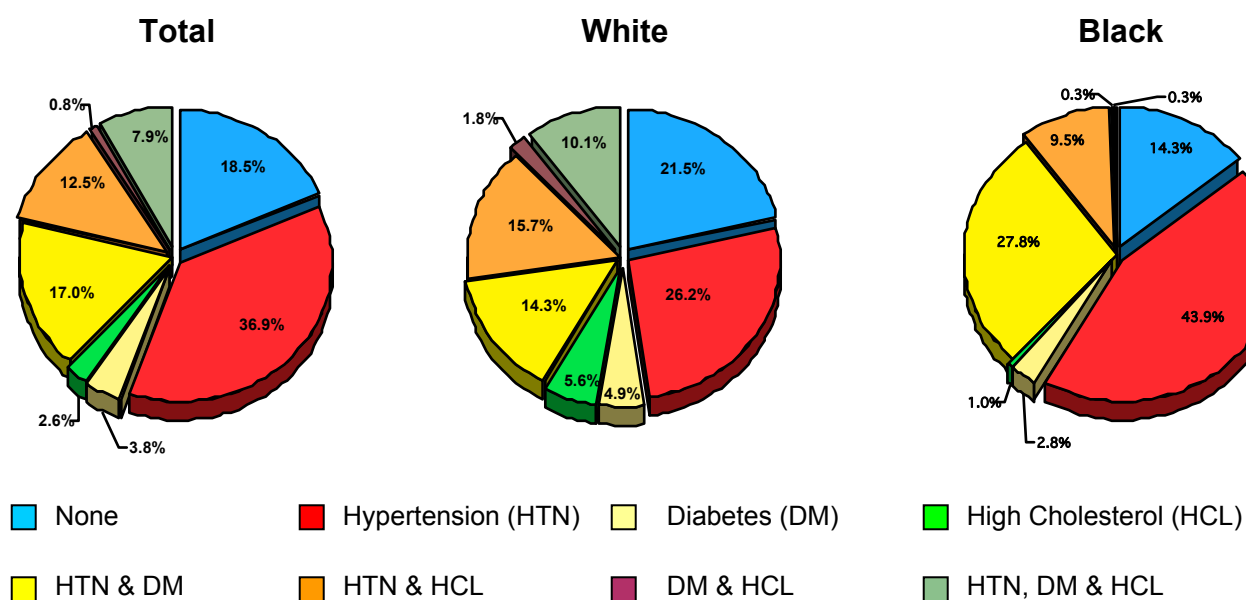


Figure 3.5. Co-morbidity of Diseases of the Heart with Hypertension, Diabetes and Hypercholesterolemia, 2002, Tennessee, HDDS Inpatient Files

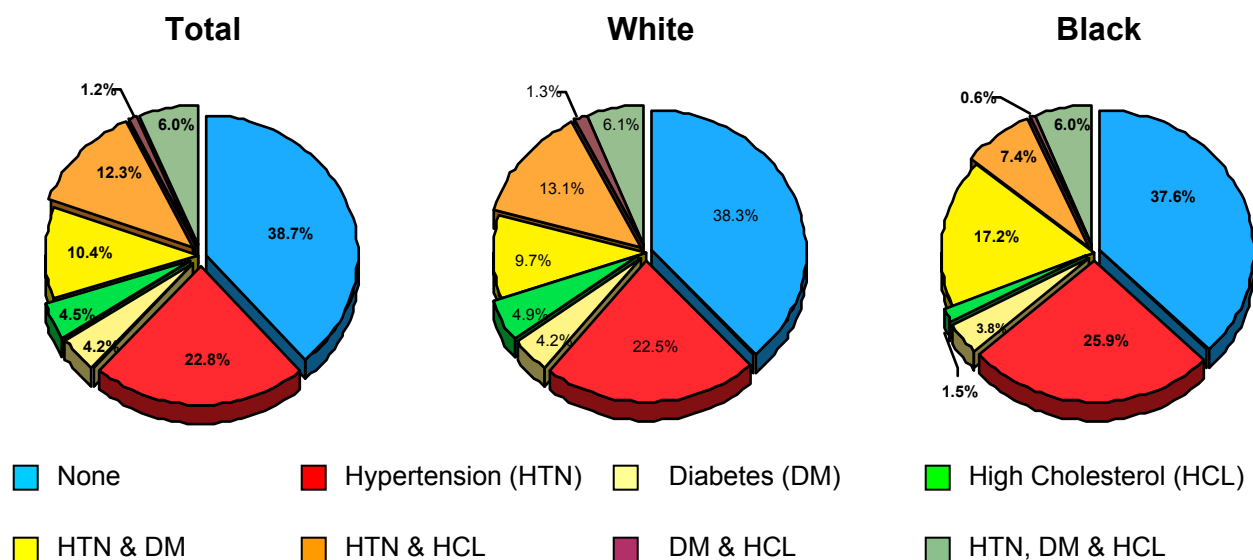


Figure 3.6. Co-morbidity of Diseases of the Heart with Hypertension, Diabetes and Hypercholesterolemia, 2002, Tennessee, HDDS Outpatient Files

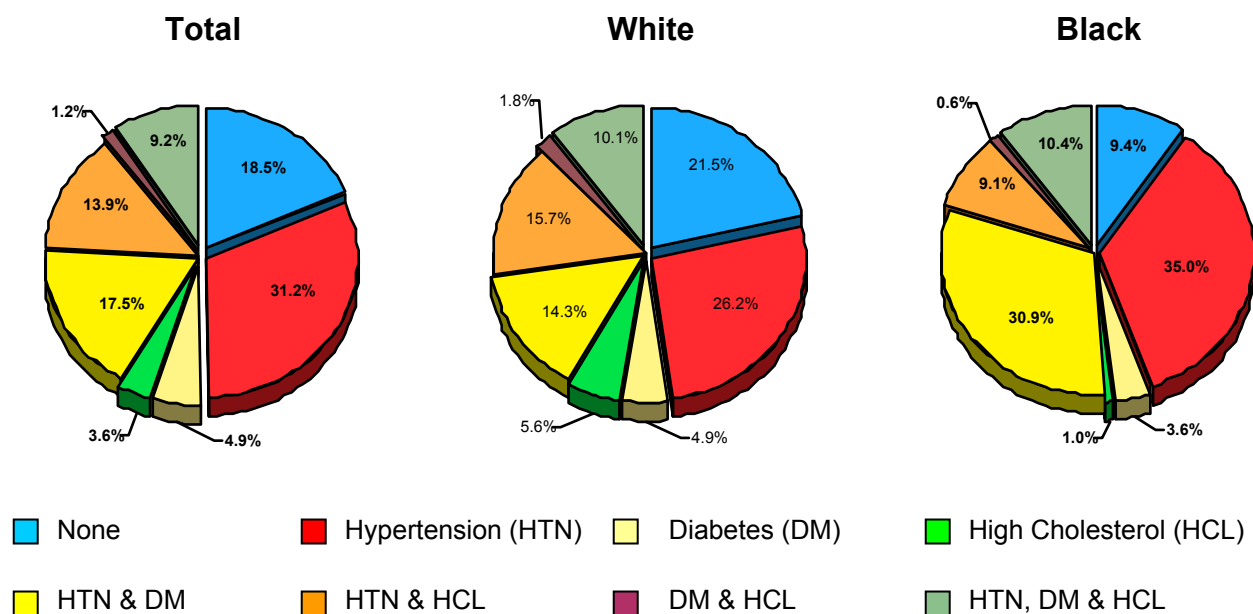


Figure 3.7. Co-morbidity of Diseases of the Heart with Hypertension, Diabetes and Hypercholesterolemia, 2002, Tennessee, CMS Inpatient Files

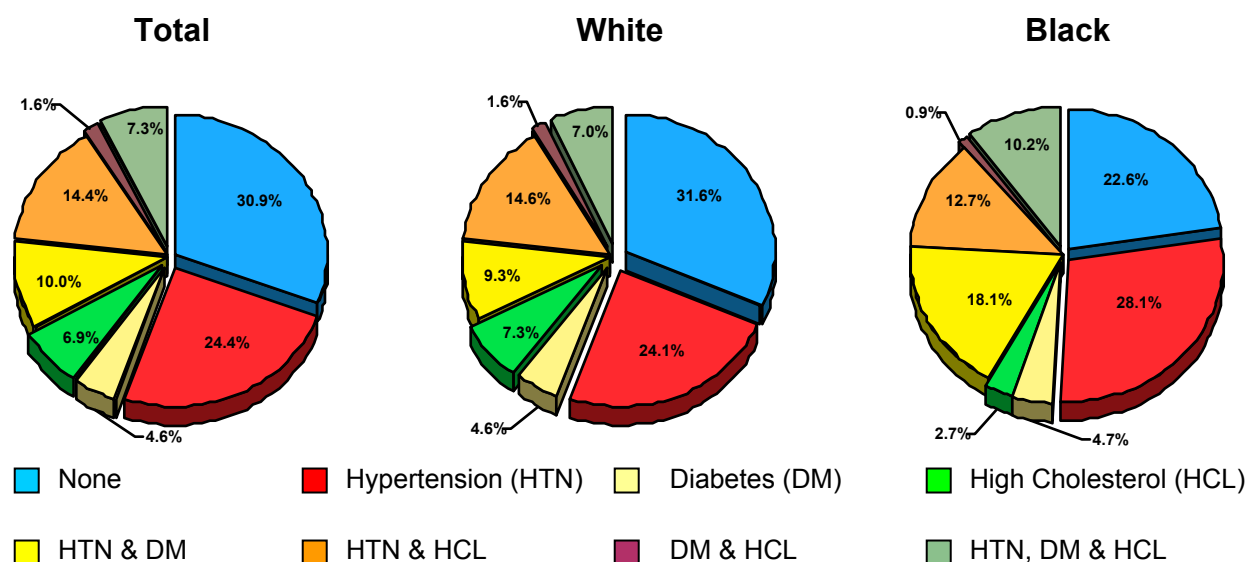


Figure 3.8. Co-morbidity of Diseases of the Heart with Hypertension, Diabetes and Hypercholesterolemia, 2002, Tennessee, CMS Outpatient Files

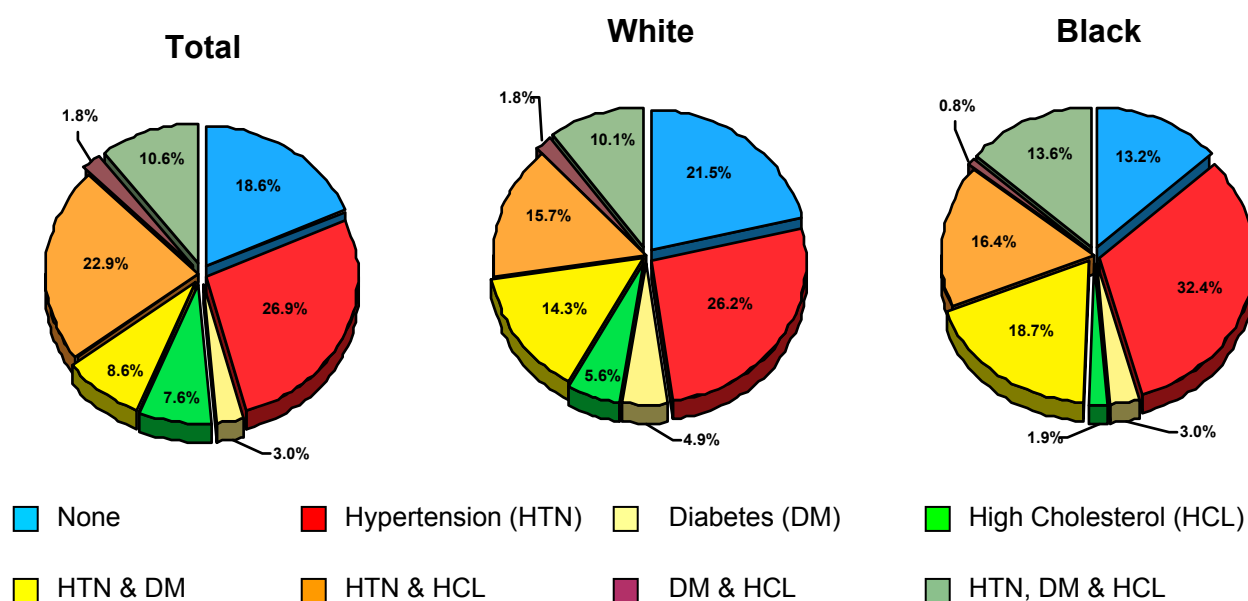


Figure 3.9. Co-morbidity of Diseases of the Heart with Hypertension, Diabetes and Hypercholesterolemia, 2002, Tennessee, CMS Carrier Files

Table 3.7. Reports the number of deaths and age-adjusted mortality rates from DOH based on the Death Statistical System Summary (DSSS) for Tennessee from 1996 to 2002. Approximately 16,000 people died from DOH in Tennessee annually, with only a 0.2% decrease in the annual number of DOH deaths during this time period. The age-adjusted mortality rate from DOH decreased by 9% from 313.6 to 284.7 per 100,000 deaths during this time period (See **Figure 3.10.**).

Blacks had higher age-adjusted mortality rates from DOH compared to Whites (360.4/100,000 and 275.4/100,000, respectively, in 2002), and men had higher rates than women (357.3/100,000 and 232.9/100,000, respectively, in 2002). The race-gender pattern of DOH mortality rates mirrors the HDDS inpatient DOH rates, with the highest rates for Black men (462.5/100,000 in 2002), followed by White men (345.8/100,000 in 2002), Black women (296.9/100,000 in 2002), and White women with the lowest (224.2/100,000 in 2002). The mortality rate from DOH decreased the most for Black females (12%) and the least for Black males (6%) during this time period.

Table 3.7. Number of Deaths and Age-Adjusted Mortality Rate from Diseases of the Heart, Total Population, 1996-2002, Tennessee, DSSS

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	6,724	7,024	6,864	6,767	6,656	6,500	6,697
White Female	6,959	6,985	7,126	6,926	6,941	6,919	7,088
Black Male	1,158	1,170	1,162	1,149	1,162	1,029	1,155
Black Female	1,293	1,316	1,276	1,325	1,333	1,189	1,223
Total White	13,683	14,009	13,990	13,693	13,597	13,419	13,785
Total Black	2,451	2,486	2,438	2,474	2,495	2,218	2,378
Total Male	7,902	8,215	8,044	7,927	7,832	7,554	7,879
Total Female	8,272	8,322	8,422	8,263	8,295	8,125	8,325
Total	16,174	16,537	16,466	16,190	16,127	15,679	16,204
Age-adjusted Rate Per 100,000							
White Male	386.9	394.9	375.6	366.3	355.5	341.0	345.8
White Female	241.3	237.2	237.8	227.2	226.3	222.0	224.2
Black Male	492.7	495.3	482.9	474.4	475.9	416.1	462.5
Black Female	339.1	340.3	322.7	334.2	336.4	301.1	296.9
Total White	302.2	302.6	296.2	286.0	280.7	272.7	275.4
Total Black	401.0	401.6	387.5	390.9	392.0	343.8	360.4
Total Male	397.9	405.5	386.5	376.7	367.3	348.1	357.3
Total Female	253.3	249.8	248.3	239.9	239.3	230.6	232.9
Total	313.6	314.0	306.6	297.4	292.8	280.3	284.7

Per 100,000

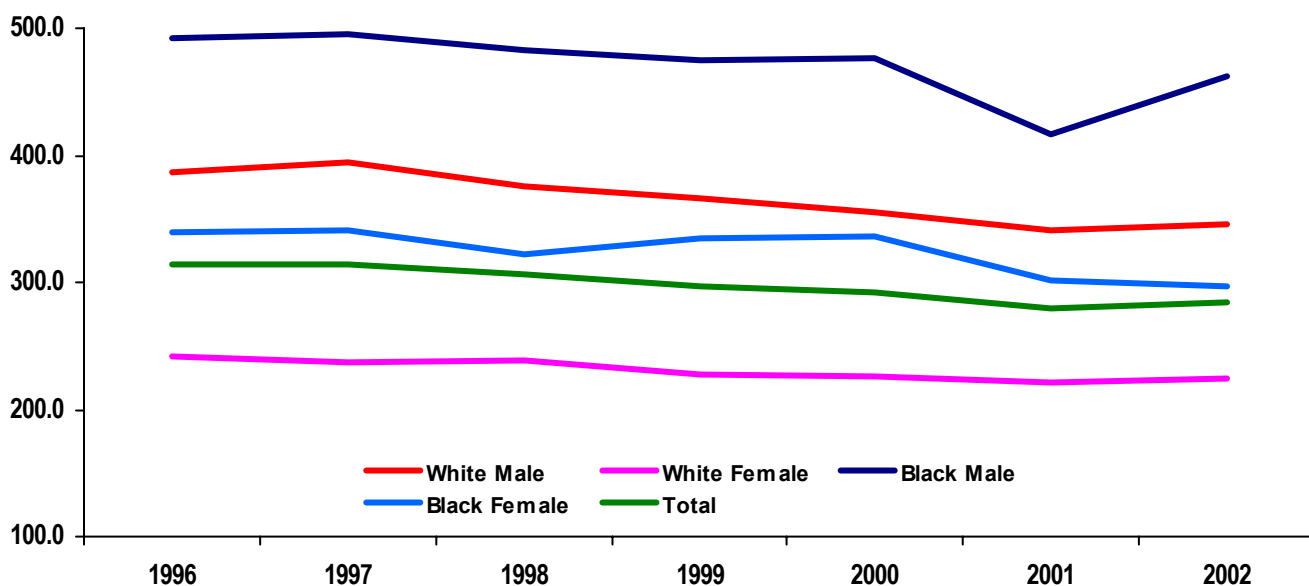


Figure 3.10. Trends in Age-adjusted Mortality Rate from Diseases of the Heart, Total Population, 1996-2002, Tennessee, DSSS

Parallel mortality data for the age 65 and over population in Tennessee are presented in **Table 3.8.** and **Figure 3.11.** Approximately 13,000 people in this age group died from DOH in Tennessee annually, such that 78-80% of the people who died from DOH each year were age 65 and over. Not surprisingly, the age-adjusted mortality rates from DOH for this age group were much higher than the rates for the general population. The age-adjusted mortality rates from DOH for the age 65 and over population in Tennessee decreased by 10% from 2,004.9 to 1,798.8 per 100,000 deaths during this time period.

As with the total Tennessee population, within the age 65 and over population age-adjusted mortality rates from DOH were consistently higher for Blacks compared to Whites (2,056.0/100,000 and 1,773.8/100,000, respectively, in 2002), and higher for men compared to women (2,197.7/100,000 and 1,554.8/100,000,

respectively, in 2002). The race-gender pattern of DOH mortality rates for the age 65 and over population mirrors the pattern for the total population, with the highest rates for Black men (2,596.1/100,000 in 2002), followed by White men (2,161.5/100,000 in 2002), Black women (1,771.1/100,000 in 2002), and White women with the lowest (1,531.3/100,000 in 2002). As with the total population, the mortality rate from DOH for age 65 and over decreased the most for Black females (15%) and the least for Black males (5%) during this time period.

Table 3.8. Number of Deaths and Age-adjusted Mortality Rate from Diseases of the Heart, Age 65 and Over, 1996-2002, Tennessee, DSSS

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	4,959	5,120	5,025	4,930	4,841	4,700	4,807
White Female	6,247	6,265	6,366	6,260	6,209	6,108	6,256
Black Male	712	722	699	693	661	601	656
Black Female	1,011	1,027	991	1,021	1,016	902	891
Total White	11,206	11,385	11,391	11,190	11,050	10,808	11,063
Total Black	1,723	1,749	1,690	1,714	1,677	1,503	1,547
Total Male	5,680	5,857	5,735	5,627	5,511	5,313	5,477
Total Female	7,276	7,309	7,370	7,291	7,241	7,021	7,159
Total	12,956	13,166	13,105	12,918	12,752	12,334	12,636
Age-adjusted Rate Per 100,000							
White Male	2,440.1	2,475.7	2,364.7	2,307.5	2,239.0	2,142.1	2,161.5
White Female	1,673.0	1,643.3	1,643.0	1,592.4	1,569.3	1,514.4	1,531.3
Black Male	2,722.0	2,778.6	2,679.8	2,667.8	2,612.3	2,343.5	2,596.1
Black Female	2,090.4	2,103.5	1,989.4	2,063.5	2,065.0	1,863.7	1,771.1
Total White	1,967.8	1,958.4	1,925.2	1,868.9	1,826.4	1,761.2	1,773.8
Total Black	2,321.8	2,343.8	2,245.7	2,287.4	2,255.5	2,008.8	2,056.0
Total Male	1,720.5	1,695.8	1,681.4	1,642.6	1,621.8	1,544.8	1,554.8
Total Female	2,464.0	2,505.9	2,392.3	2,336.4	2,269.2	2,153.7	2,197.7
Total	2,004.9	2,000.0	1,958.3	1,909.6	1,867.7	1,782.4	1,798.8

Per 100,000

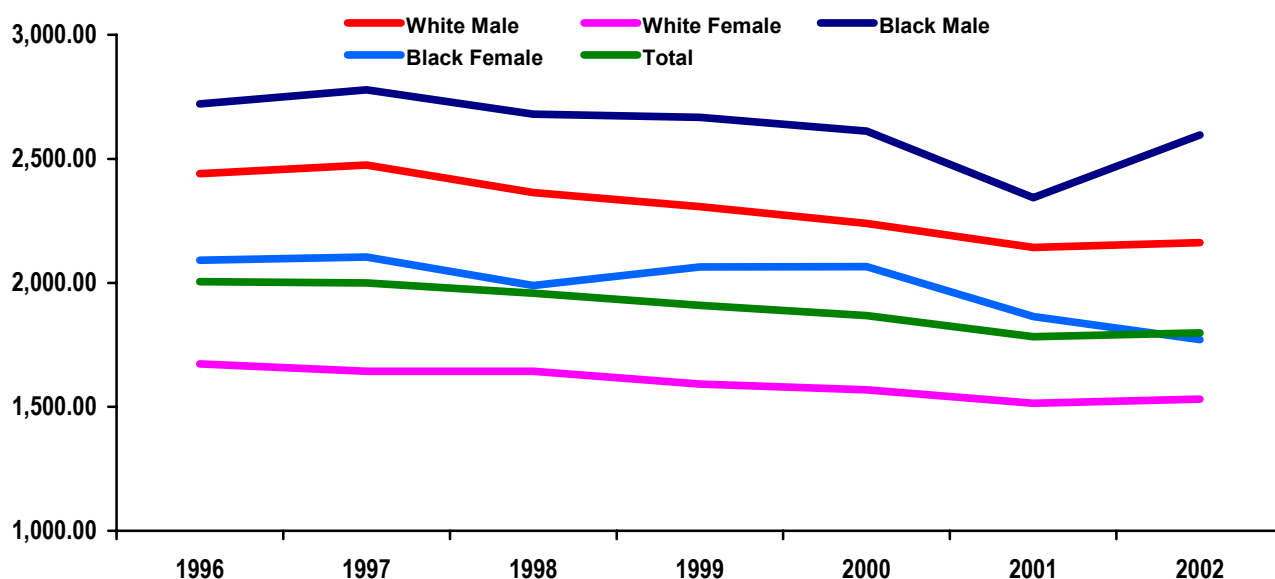


Figure 3.11. Trends in Age-adjusted Mortality Rate from Diseases of the Heart, Age 65 and Over, 1996-2002, Tennessee, DSSS

Figure 3.12. is a map of the age-adjusted mortality rates from DOH by county for the total Tennessee population, based on DSSS data (five-year average, 1998-2002). The darker portions of the map reflect higher age-adjusted mortality rates from DOH. The ten counties with the lowest age-adjusted mortality rates from DOH in Tennessee were Moore, Chester, Anderson, Johnson, Houston, Williamson, Grainger, Blount, Sullivan, and Knox (ranging

from 200.2 to 255.4/100,000 deaths). The ten counties with the highest age-adjusted mortality rates from DOH were Lauderdale, Lake, Pickett, Carroll, Benton, Claiborne, Clay, Jackson, Perry, and Henry (ranging from 354.4/100,000 deaths in Henry to 423.0/100,000 in Lauderdale).

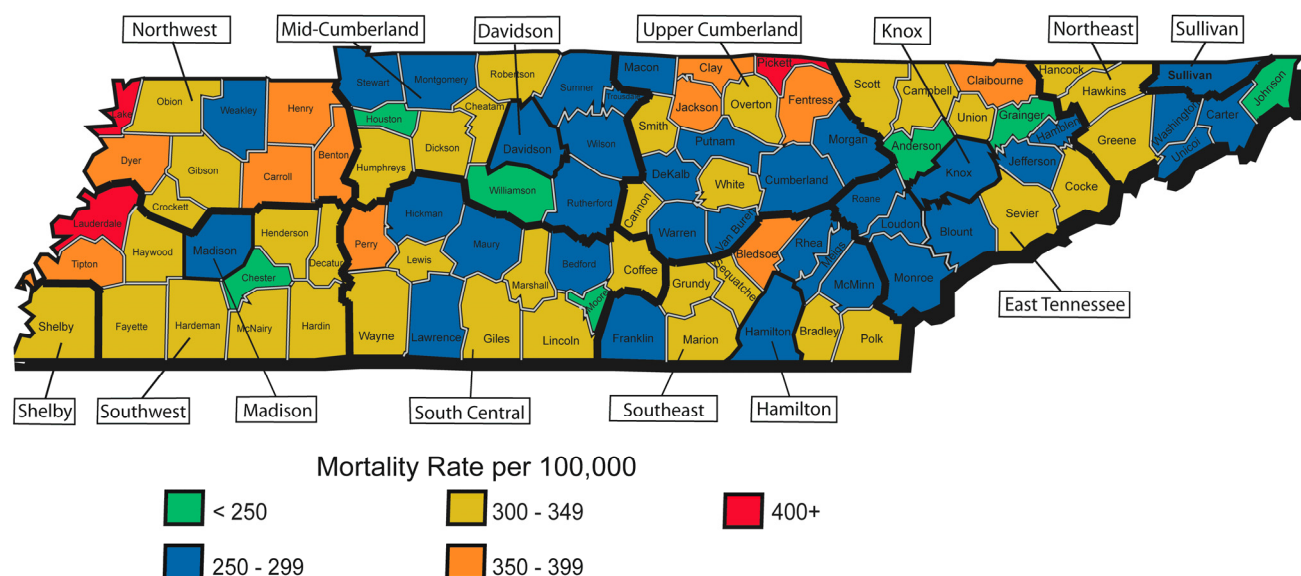


Figure 3.12. Average Age-adjusted Mortality Rate from Diseases of the Heart by County and Health Service Region, Total Population, 1998-2002, Tennessee, DSSS

Figure 3.13 is a map of the age-adjusted mortality rates from DOH by county for the age 65 and over population, based on DSSS data (five-year average, 1998-2002). Again, the darker portions of the map reflect higher age-adjusted mortality rates from DOH. The ten counties with the lowest age-adjusted mortality rates from DOH among the elderly in Tennessee were Moore, Johnson, Chester, Anderson, Houston, Grainger, Monroe, Hickman, Blount, and Hamblen (ranging from 1,151.5 to 1,642.3/100,000). Seven of these were also among the lowest counties for mortality from DOH in the total population. The ten counties with the highest age-adjusted rates of DOH among the elderly were Pickett, Lauderdale, Lake, Claiborne, Carroll, Bledsoe, Benton, Henry, Jackson, and Clay (ranging from 2,331.6/100,000 in Clay to 2,875.0/100,000 in Pickett). Eight of these were also among the highest counties for mortality from DOH in the total population.

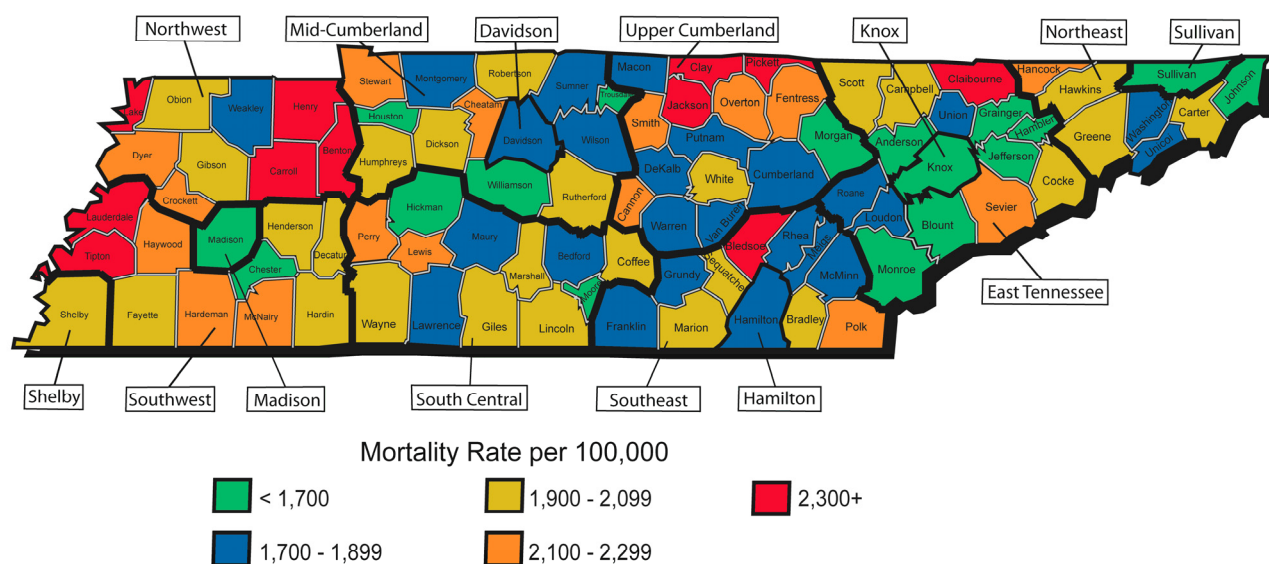


Figure 3.13. Average Age-adjusted Mortality Rate from Diseases of the Heart by County and Health Service Region, Age 65 and over, 1998-2002, Tennessee, DSSS

- **Figure 3.14 & Table 3.9.** present calculations of years of potential life lost (YPLL) due to mortality from DOH based on the DSSS for Tennessee from 1996 to 2002. Years of potential life lost (YPLL) measures

the impact of premature mortality, and is the sum of the number of years that people died before age 75 (which is average life expectancy). The total annual YPLL from DOH increased by 8.5% from 86,218 in 1996 to 93,529 in 2002, with a total YPLL of 623,513 during this time period. Annual YPLL from DOH increased twice as rapidly for women (12.2%) compared to men (6.7%). The YPLL rate due to DOH was highest for Black males (2,861.8) and lowest for White females (938.1).

Figure 3.14. Total Number of Years of Potential Life Lost from Diseases of the Heart, 1996-2002, Tennessee, DSSS

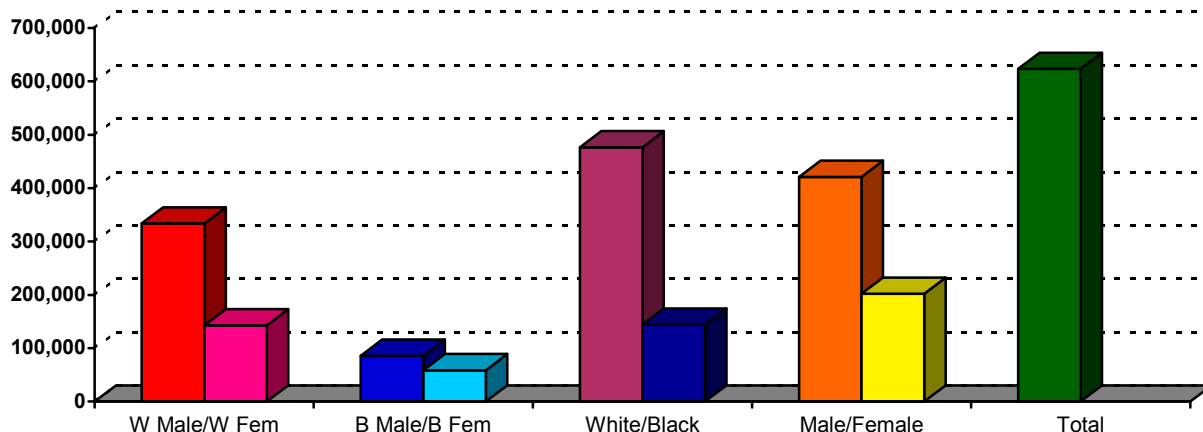


Table 3.9. Years of Potential Life Lost from Diseases of the Heart, 1996-2002, Tennessee, DSSS

GROUP	1996	1997	1998	1999	2000	2001	2002	Total
White Male	45,964	50,180	48,208	47,388	46,982	45,856	49,151	333,729
White Female	19,645	19,816	20,793	18,802	19,870	21,897	22,014	142,837
Black Male	12,169	12,178	12,207	12,144	12,957	11,262	12,862	85,779
Black Female	8,055	8,301	7,980	8,522	8,608	7,982	9,091	58,539
Total White	65,609	69,996	69,001	66,190	66,852	67,753	71,165	476,566
Total Black	20,224	20,479	20,187	20,666	21,565	19,244	21,953	144,318
Total Male	58,426	62,588	60,603	59,745	60,075	57,533	62,348	421,318
Total Female	27,792	28,225	28,930	27,412	28,565	30,090	31,181	202,195
Total	86,218	90,813	89,533	87,157	88,640	87,623	93,529	623,513

Table 3.10. reports on the three major subtypes of DOH diagnoses within the HDDS and CMS inpatient files, HDDS and CMS outpatient files, and CMS carrier (physician) file, all at the event level for 2002. In the HDDS inpatient file, among all inpatient visits for DOH, just under half had CHD as the primary diagnosis, about 18% had MI as the primary diagnosis, and about a quarter had CHF as the primary diagnosis. In the CMS inpatient file, among all inpatient visits for DOH among the 65 and over population, just under half had CHD as the primary diagnosis, about 16% had MI as the primary diagnosis, and 30% had CHF as the primary diagnosis.

In the HDDS outpatient file, among all inpatient visits for DOH, just over half had CHD as the primary diagnosis, 6% had MI as the primary diagnosis, and 12% had CHF as the primary diagnosis. In the CMS outpatient file, among all inpatient visits for DOH among the 65 and over population, almost one-third had CHD as the primary diagnosis, 2% had MI as the primary diagnosis, and 22% had CHF as the primary diagnosis. In the CMS carrier file, among all physician visits for DOH among the 65 and over population, just over one-third had CHD as the primary diagnosis, 3% had MI as the primary diagnosis, and 18% had CHF as the primary diagnosis.

In all of the HDDS and CMS files for the total population as well as the 65 and over population, CHD and MI diagnoses were more common among men than women, while CHF was more common among women. At the same time, CHD and MI diagnoses were also more common among Whites than Blacks, while CHF was more common among Blacks.

Table 3.10. Major Subtypes of Diseases of the Heart, 2002, Tennessee, HDDS and CMS Inpatient Files

GROUP	HDDS Inpatient	HDDS Outpatient	CMS Inpatient	CMS Outpatient	CMS Carrier
Coronary Heart Disease					
White Male	56.9%	62.7%	50.0%	37.7%	42.9%
White Female	40.5%	47.5%	37.7%	25.4%	29.9%
Black Male	37.3%	37.9%	33.5%	27.8%	31.3%
Black Female	30.9%	33.3%	29.0%	26.1%	27.3%
Total White	49.1%	56.1%	43.5%	31.1%	36.2%
Total Black	33.7%	35.5%	30.7%	26.7%	28.9%
Total Male	54.7%	60.5%	36.5%	25.5%	29.6%
Total Female	39.1%	45.7%	48.2%	37.1%	42.0%
Total	47.1%	53.9%	41.9%	30.8%	35.5%
Myocardial Infarction					
White Male	21.4%	7.5%	18.2%	2.2%	3.4%
White Female	15.9%	5.1%	15.6%	1.7%	3.1%
Black Male	14.2%	3.3%	12.9%	1.9%	2.9%
Black Female	10.5%	2.3%	10.8%	1.6%	2.5%
Total White	18.8%	6.5%	16.8%	1.9%	3.2%
Total Black	12.1%	2.8%	11.6%	1.7%	2.6%
Total Male	20.5%	7.1%	17.6%	2.2%	3.3%
Total Female	15.2%	4.8%	14.9%	1.7%	3.0%
Total	17.9%	6.1%	16.2%	1.9%	3.2%
Congestive Heart Failure					
White Male	19.5%	8.7%	25.5%	18.3%	14.9%
White Female	28.2%	14.0%	31.1%	24.4%	19.3%
Black Male	34.0%	20.3%	38.4%	30.4%	24.3%
Black Female	37.9%	23.2%	41.2%	31.9%	26.5%
Total White	23.6%	11.0%	28.5%	21.6%	17.2%
Total Black	36.2%	21.8%	40.1%	31.3%	25.7%
Total Male	21.2%	9.7%	26.9%	19.2%	15.6%
Total Female	29.6%	15.0%	32.6%	25.0%	20.1%
Total	25.3%	12.1%	29.9%	22.4%	18.0%

B. Coronary Heart Disease

(ICD-9-CM: 410 – 414, 429.2) (ICD-10: I20 – I25)

Tables 3.11.-3.15. report the frequency and age-adjusted rates of coronary heart disease (CHD) as a primary diagnosis from several data sources: inpatient files from HDDS (all ages) and CMS (age 65 and over), outpatient files from HDDS and CMS, and carrier (physician) files from CMS (See Technical Notes in Appendix A). The tables report data for the state of Tennessee for the total sample (including all races), by race, by gender, and by race-gender groups, covering the period of 1997-2002 for HDDS and 1996-2002 for CMS. The trends for HDDS inpatient data and CMS inpatient data are also illustrated in **Figures 3.15.** and **3.16.**

According to the HDDS data, the number of inpatients in Tennessee with a primary diagnosis of CHD increased by 6% from 33,718 in 1997 to 35,823 in 2002 (See **Table 3.11.**). However, the age-adjusted rates decreased by 2% from 617.7 to 604.9 per 100,000 population during this time period (See **Figure 3.15.**). This suggests that most of the raw increase in inpatients seen for CHD was due to aging and population growth.

The age-adjusted rates of CHD among inpatients were consistently almost twice as high for men compared to women. In 1997 the inpatient CHD rate was higher for Blacks compared to Whites. However, the Black rate decreased by 14% compared to a 3% decrease for Whites, such that Whites had a higher rate in 2002. White men had the highest age-adjusted rate of CHD (788.2/100,000 in 2002), followed by Black men (610.8/100,000 in 2002), although the rate for Black men decreased by 17% from 1997 to 2002. Black women had the third highest age-adjusted rates of CHD (467.0/100,000 in 2002), which decreased by 10% from 1997 to 2002. White women consistently had the lowest rate (405.3/100,000 in 2002).

Table 3.11. Frequency and Age-adjusted Rate of Coronary Heart Disease, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Frequencies						
White Male	17,302	17,137	18,077	17,925	17,913	18,201
White Female	11,148	11,184	11,275	11,613	11,344	11,768
Black Male	1,972	2,322	1,566	1,569	1,564	1,806
Black Female	1,963	2,091	1,819	1,655	1,611	1,910
Total White	28,455	28,336	29,362	29,539	29,257	29,969
Total Black	3,936	4,418	3,386	3,224	3,175	3,716
Total Male	20,100	20,927	20,943	21,185	21,389	21,355
Total Female	13,612	14,131	13,823	14,278	14,168	14,468
Total	33,718	35,080	34,777	35,464	35,557	35,823
Age-adjusted Rate Per 100,000						
White Male	815.2	794.4	817.8	804.5	788.6	788.2
White Female	411.1	404.5	402.1	411.0	396.0	405.3
Black Male	739.0	863.0	565.7	558.6	545.4	610.8
Black Female	520.2	544.7	468.8	421.6	403.5	467.0
Total White	595.6	582.1	592.6	590.0	575.6	580.1
Total Black	614.3	678.9	510.8	482.0	462.2	529.6
Total Male	834.4	853.0	835.4	836.5	829.4	812.5
Total Female	438.4	447.1	430.8	440.4	431.0	433.7
Total	617.7	630.6	614.3	619.4	610.9	604.9

Per 100,000

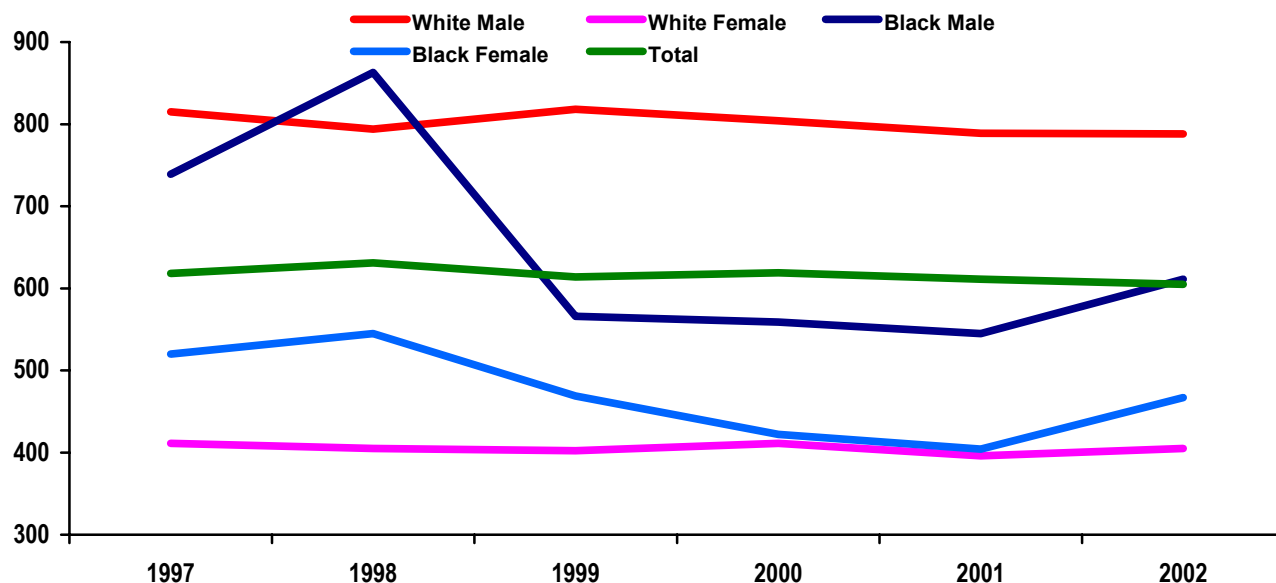


Figure 3.15. Trends in Age-adjusted Rate of Coronary Heart Disease, 1997-2002, Tennessee, HDDS Inpatient Files

According to CMS data, the number of inpatients age 65 and over in Tennessee with a primary diagnosis of CHD decreased by 3% from 18,878 in 1996 to 18,299 in 2002 (See **Table 3.12.**). The age-adjusted rates of CHD among inpatients were about four times higher for the 65 and over population (CMS) compared to the general population (HDDS). Disregarding the 1997 data anomaly, overall, the age-adjusted rates of CHD among elderly inpatients decreased by 7% from 2,611.1 per 100,000 to 2,424.9 per 100,000 population from 1996 to 2002 (See **Figure 3.16.**).

The age-adjusted rates of CHD among inpatients age 65 and over were consistently higher for men compared to women. In all years, the rate of CHD was higher for elderly Whites compared to elderly Blacks, although the rates started to converge somewhat given that the rate for Blacks increased by 13% and the rate for White decreased by 9% from 1996 to 2002. These same patterns persist when comparing elderly White men and Black men, but elderly Black women started with lower rates than White women in 1997 and surpassed them by 1999. Elderly white men had the highest age-adjusted rate of CHD as inpatients in 2002 (3,153.7/100,000), and Black men had the second highest (2,127.9/100,000), followed by Black women (2,044.0/100,000) and White women (1,993.0/100,000).

Table 3.12. Frequency and Age-adjusted Rate of Coronary Heart Disease, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	8,701	5,961	8,640	8,535	8,751	8,310	8,617
White Female	8,509	5,611	7,988	7,748	8,035	7,573	7,985
Black Male	544	316	575	566	608	538	608
Black Female	868	544	876	971	960	869	976
Total White	17,210	11,572	16,628	16,283	16,786	15,883	16,602
Total Black	1,412	860	1,451	1,537	1,568	1,407	1,584
Total Male	9,378	6,327	9,299	9,189	9,405	8,890	9,282
Total Female	9,500	6,232	8,985	8,828	9,068	8,496	9,017
Total	18,878	12,559	18,284	18,017	18,473	17,386	18,299

Table 3.12. Continued

GROUP	1996	1997	1998	1999	2000	2001	2002
Age-adjusted Rate Per 100,000							
White Male	3,418.8	2,333.7	3,311.8	3,226.7	3,263.0	3,059.7	3,153.7
White Female	2,232.8	1,450.5	2,051.5	1,976.2	2,016.9	1,893.4	1,993.0
Black Male	1,897.5	1,089.9	2,012.0	2,007.2	2,123.4	1,915.3	2,127.9
Black Female	1,814.3	1,125.9	1,827.1	2,035.1	1,969.0	1,801.2	2,044.0
Total White	2,714.8	1,803.2	2,561.0	2,486.0	2,518.2	2,371.9	2,467.3
Total Black	1,840.4	1,111.8	1,897.3	2,019.2	2,030.9	1,834.1	2,085.1
Total Male	3,452.3	2,321.7	10.6	3,285.0	3,345.7	3,124.6	3,229.9
Total Female	2,310.8	1,498.0	10.2	2,096.7	2,140.5	1,989.5	2,093.5
Total	2,611.1	1,724.1	2,484.5	2,429.1	2,470.8	2,313.6	2,424.9

Per 100,000

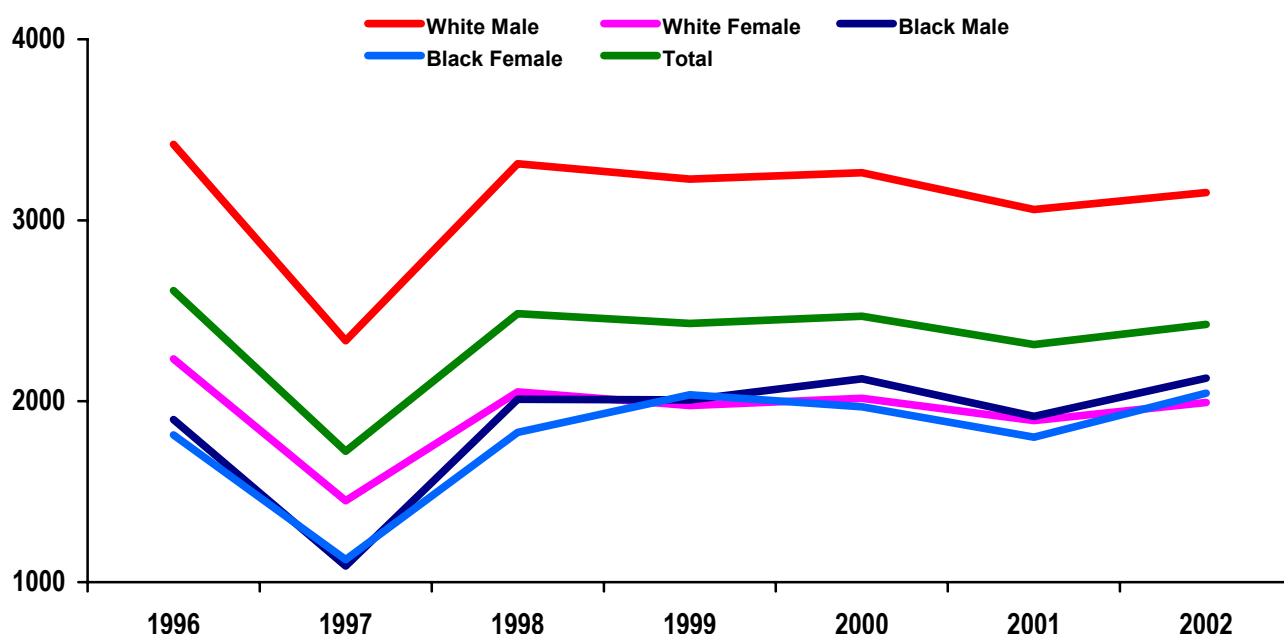


Figure 3.16. Trends in Age-adjusted Rate of Coronary Heart Disease, 1996-2002, Tennessee, CMS Inpatient Files

According to the HDDS data, the number of outpatients in Tennessee with a primary diagnosis of CHD increased by 105% from 12,623 in 1997 to 25,819 in 2002 (See **Table 3.13.**). However, the age-adjusted rates also increased by 87% from 230.1 to 430.1 per 100,000 population during this time period. This suggests that the raw increase in outpatients seen for CHD was not merely due to an aging population.

The age-adjusted rates of CHD among outpatients were consistently nearly twice as high for men compared to women. In all years, the outpatient rate of CHD was higher for Whites compared to Blacks, and the race difference in outpatient CHD rates widened from 1997 to 2002 given that the rate for Whites increased by 89% and the rate for Blacks only increased by 64%. These same gender and race patterns persist when comparing the four race-gender subgroups. White men had the highest age-adjusted rate of CHD as outpatients in 2002 (580.8/100,000), and Black men had the second highest (321.3/100,000), followed by White women (299.1/100,000) and Black women (236.5/100,000).

Table 3.13. Frequency and Age-adjusted Rate of Coronary Heart Disease, 1997-2002, Tennessee, HDDS Outpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Frequencies						
White Male	6,772	8,358	8,851	11,507	12,191	13,942
White Female	4,112	5,072	5,468	7,101	7,206	8,416
Black Male	557	769	663	804	759	1,005
Black Female	528	615	679	783	737	995
Total White	10,885	13,431	14,320	18,608	19,397	22,358
Total Black	1,085	1,384	1,342	1,588	1,496	2,000
Total Male	7,729	9,604	9,984	13,290	14,126	15,921
Total Female	4,892	5,954	6,398	8,438	8,523	9,898
Total	12,623	15,559	16,384	21,729	22,649	25,819
Age-adjusted Rate Per 100,000						
White Male	310.7	376.0	388.2	494.6	514.7	580.8
White Female	155.1	188.9	200.8	259.0	259.8	299.1
Black Male	202.7	275.3	232.1	271.0	246.5	321.3
Black Female	138.6	160.0	171.8	195.7	180.0	236.5
Total White	227.3	275.1	288.1	369.5	378.9	429.5
Total Black	165.7	208.0	196.4	227.4	208.4	272.2
Total Male	312.2	380.1	384.8	501.5	522.6	580.8
Total Female	160.5	192.4	203.8	266.2	265.1	303.2
Total	230.1	277.9	287.0	375.0	384.0	430.1

According to CMS data, the number of outpatients age 65 and over in Tennessee with a primary diagnosis of CHD increased by 18% from 27,264 in 1996 to 32,167 in 2002 (See **Table 3.14.**). (Note: The number of CHD cases in the CMS outpatient data is greater than in the HDDS outpatient data because not all facilities report to HDDS [e.g., VA facilities, non-hospital-affiliated outpatient clinics], while they all bill to CMS). The age-adjusted rates of CHD among outpatients were much higher for the 65 and over population (CMS) compared to the general population (HDDS). Overall, the age-adjusted rates of CHD among elderly outpatients increased by 12% from 3,784.7 per 100,000 to 4,243.6 per 100,000 population from 1996 to 2002. This suggests that most of the raw increase in outpatients seen for CHD was due to an aging population.

The age-adjusted rates of CHD among outpatients age 65 and over were consistently higher for men compared to women, and higher for Whites compared to Blacks. In 2002, among the elderly population, White males had the highest age-adjusted rate of CHD as outpatients (5,888.9/100,000 in 2002), followed by White females (3,390.0/100,000), Black males (2,766.7/100,000), and Black females with the lowest rate (2,695.1/100,000).

Table 3.14. Frequency and Age-adjusted Rate of Coronary Heart Disease, 1996-2002, Tennessee, CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	12,545	11,320	15,899	15,327	15,614	16,135	16,321
White Female	12,740	16,590	14,507	14,014	13,960	14,011	13,576
Black Male	585	998	700	727	713	770	796
Black Female	1,043	1,736	1,140	1,238	1,263	1,191	1,299
Total White	25,285	27,910	30,406	29,341	29,574	30,146	29,897
Total Black	1,628	2,734	1,840	1,965	1,976	1,961	2,095
Total Male	13,296	12,431	16,743	16,215	16,407	16,976	17,210
Total Female	13,968	18,587	15,842	15,452	15,309	15,282	14,957
Total	27,264	31,018	32,585	31,667	31,716	32,258	32,167

Table 3.14. Continued

GROUP	1996	1997	1998	1999	2000	2001	2002
Age-adjusted Rate Per 100,000							
White Male	4,956.7	4,361.3	6,101.3	5,802.3	5,767.1	5,899.6	5,888.9
White Female	3,338.7	4,264.6	3,720.2	3,568.3	3,501.5	3,504.0	3,390.0
Black Male	2,094.8	3,451.5	2,483.6	2,581.5	2,523.7	2,688.3	2,766.7
Black Female	2,157.3	3,581.1	2,352.4	2,586.8	2,601.2	2,468.2	2,695.1
Total White	4,003.6	4,300.0	4,695.0	4,485.6	4,426.2	4,490.4	4,422.6
Total Black	2,128.6	3,533.1	2,398.6	2,585.8	2,559.7	2,551.1	2,728.8
Total Male	4,918.8	4,518.3	6,064.7	5,794.2	5,797.0	5,927.9	5,925.6
Total Female	3,387.4	4,478.5	3,768.4	3,662.4	3,617.2	3,583.8	3,481.8
Total	3,784.7	4,213.3	4,438.7	4,274.1	4,232.9	4,282.5	4,243.6

According to CMS carrier (physician) data, the number of patients age 65 and over in Tennessee who were seen by a physician with a primary diagnosis of CHD increased by 5% from 117,938 in 1996 to 123,733 in 2002 (See **Table 3.15**). Overall, the age-adjusted rates of physician-diagnosed CHD among elderly patients decreased by 1% from 16,537.2 per 100,000 to 16,414.8 per 100,000 population from 1996 to 2002. This suggests that some of the raw increase in patients seen for CHD was due to an aging population.

The age-adjusted rates of physician-diagnosed CHD among the age 65 and over population were consistently higher for men compared to women, and higher for Whites compared to Blacks. In 2002, among the elderly population, White males had the highest age-adjusted rate of physician-diagnosed CHD (22,150.5/100,000), followed by White females (13,253.0/100,000), Black males (12,791.3/100,000), and Black females with the lowest rate (12,248.6/100,000).

Table 3.15. Frequency and Age-adjusted Rate of Coronary Heart Disease, 1996-2002, Tennessee, CMS Carrier Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	52,525	54,557	54,892	55,220	57,041	59,698	60,432
White Female	54,600	54,024	52,817	52,210	52,646	53,666	53,118
Black Male	3,329	3,368	3,387	3,317	3,463	3,597	3,612
Black Female	5,897	5,908	5,795	5,743	5,913	6,016	5,888
Total White	107,125	108,581	107,709	107,430	109,687	113,364	113,550
Total Black	9,226	9,276	9,182	9,060	9,376	9,613	9,500
Total Male	56,566	58,377	58,823	59,105	60,812	63,615	64,393
Total Female	61,372	60,563	59,384	58,741	58,948	60,042	59,340
Total	117,938	118,940	118,207	117,846	119,760	123,657	123,733
Age-adjusted Rate Per 100,000							
White Male	21,218.6	21,503.3	21,380.6	21,232.7	21,428.5	22,191.6	22,150.5
White Female	14,350.8	13,957.2	13,546.9	13,299.8	13,202.3	13,412.3	13,253.0
Black Male	11,975.4	12,020.6	12,146.4	11,964.5	12,307.6	12,748.8	12,791.3
Black Female	12,165.4	12,173.0	11,977.7	11,925.0	12,134.9	12,441.1	12,248.6
Total White	17,139.2	17,024.7	16,720.4	16,515.4	16,506.9	16,971.4	16,890.0
Total Black	12,096.5	12,108.4	12,044.2	11,928.8	12,189.3	12,555.9	12,476.1
Total Male	21,277.6	21,597.3	21,552.3	21,385.0	21,757.2	22,493.6	22,447.5
Total Female	14,867.7	14,504.3	14,102.7	13,893.5	13,888.3	14,043.7	13,763.1
Total	16,537.2	16,438.1	16,187.4	15,994.6	16,068.9	16,497.3	16,414.8

Figure 3.17. is a map of the age-adjusted rates of CHD by county, based on HDDS data (five-year average, 1998-2002). **Figure 3.18.** Is a map of the age-adjusted rates of CHD by county for the age 65 and over population, based on CMS data (five-year average, 1998-2002). The darker portions of the map reflect higher age-adjusted rates of CHD.

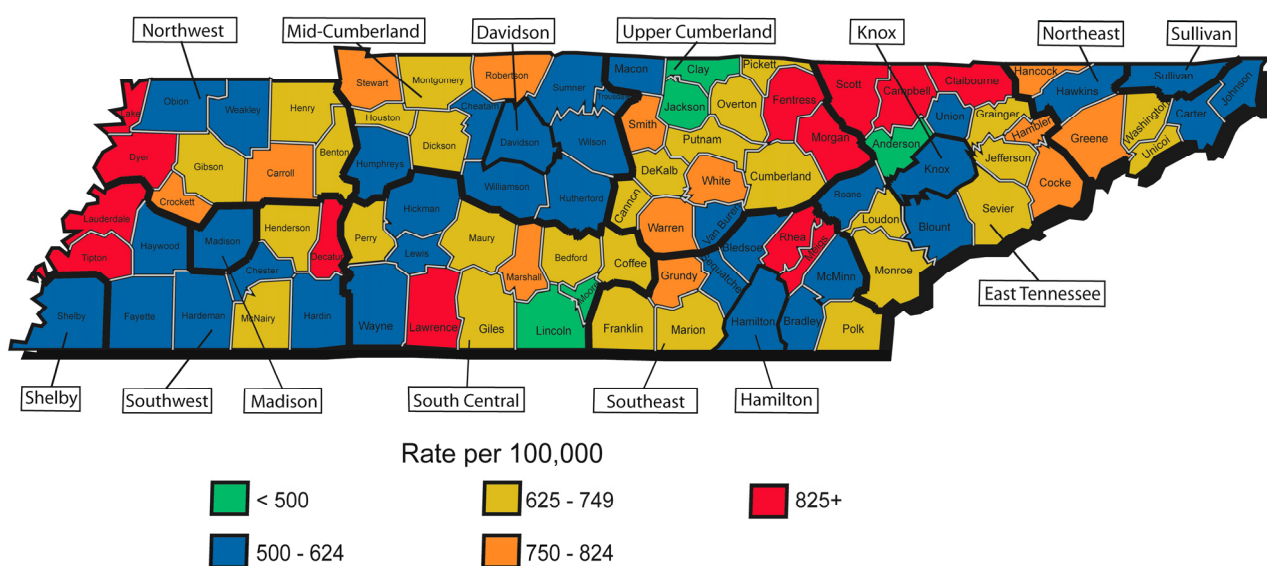


Figure 3.17. Average Age-adjusted Rate of Coronary Heart Disease by County and Health Service Region, 1998-2002, Tennessee, HDDS Inpatient Files

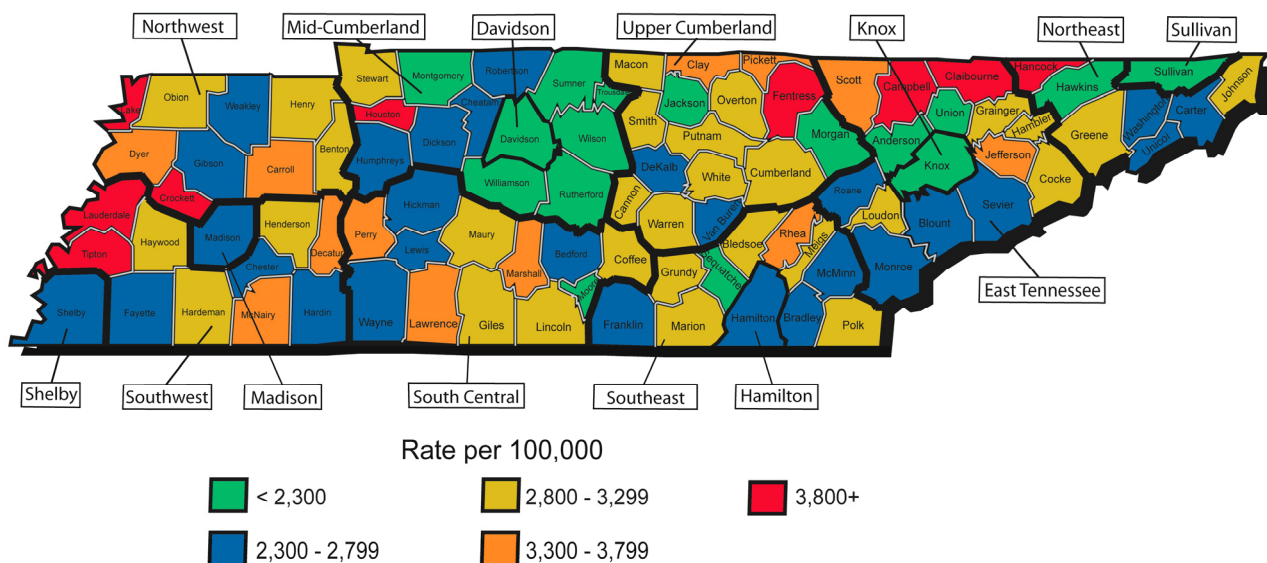


Figure 3.18. Average Age-adjusted Rate of Coronary Heart Disease by County and Health Service Region, 1998-2002, Tennessee, CMS Inpatient Files

Table 3.16. reports the number of deaths and age-adjusted mortality rates from CHD based on the Death Statistical System Summary (DSSS) for Tennessee from 1996 to 2002. Approximately 12,000 people died from CHD in Tennessee annually, with a 3% decrease in the annual number of CHD deaths during this time period. Thus, CHD accounted for around three-fourths of all DOH deaths in Tennessee. The age-adjusted mortality rate from CHD decreased by 12% from 243.9 to 215.1 per 100,000 deaths from 1996 to 2002 (See **Figure 3.19.**).

Men consistently had higher age-adjusted mortality rates from CHD compared to women (281.2/100,000 and 168.3/100,000, respectively, in 2002), and Blacks had slightly higher rates than Whites (251.4/100,000 and 211.4/100,000, respectively, in 2002). Although White men had the highest rates of CHD diagnoses in the HDDS inpatient data, Black men had the highest age-adjusted mortality rate from CHD (336.7/100,000 in 2002), followed by White men (276.3/100,000 in 2002), Black women (198.4/100,000 in 2002), and White women with the lowest (164.5/100,000 in 2002). The mortality rate from CHD decreased the least for Black males (only 1%).

Table 3.16. Number of Deaths and Age-adjusted Mortality Rate from Coronary Heart Disease, Total Population, 1996-2002, Tennessee, DSSS

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	5,549	5,743	5,596	5,390	5,404	5,267	5,370
White Female	5,374	5,411	5,334	5,031	5,140	5,176	5,225
Black Male	781	763	790	771	805	675	810
Black Female	842	841	797	856	879	792	808
Total White	10,923	11,154	10,930	10,421	10,544	10,443	10,595
Total Black	1,623	1,604	1,587	1,627	1,684	1,467	1,618
Total Male	6,347	6,520	6,399	6,169	6,215	5,962	6,196
Total Female	6,233	6,268	6,142	5,895	6,036	5,977	6,044
Total	12,580	12,788	12,541	12,064	12,251	11,939	12,240
Age-adjusted Rate Per 100,000							
White Male	318.0	322.8	305.7	290.1	286.7	276.3	276.3
White Female	185.9	183.2	177.5	164.8	167.2	165.6	164.5
Black Male	340.1	330.7	336.4	324.7	342.6	278.6	336.7
Black Female	222.1	218.8	203.9	218.1	224.1	203.0	198.4
Total White	241.0	240.8	231.1	217.2	217.3	211.9	211.4
Total Black	268.8	262.7	256.7	260.5	270.1	231.7	251.4
Total Male	319.5	322.7	307.9	292.7	291.1	275.5	281.2
Total Female	190.3	187.5	180.4	170.9	173.6	169.1	168.3
Total	243.9	242.9	233.5	221.5	222.3	213.4	215.1

Per 100,000

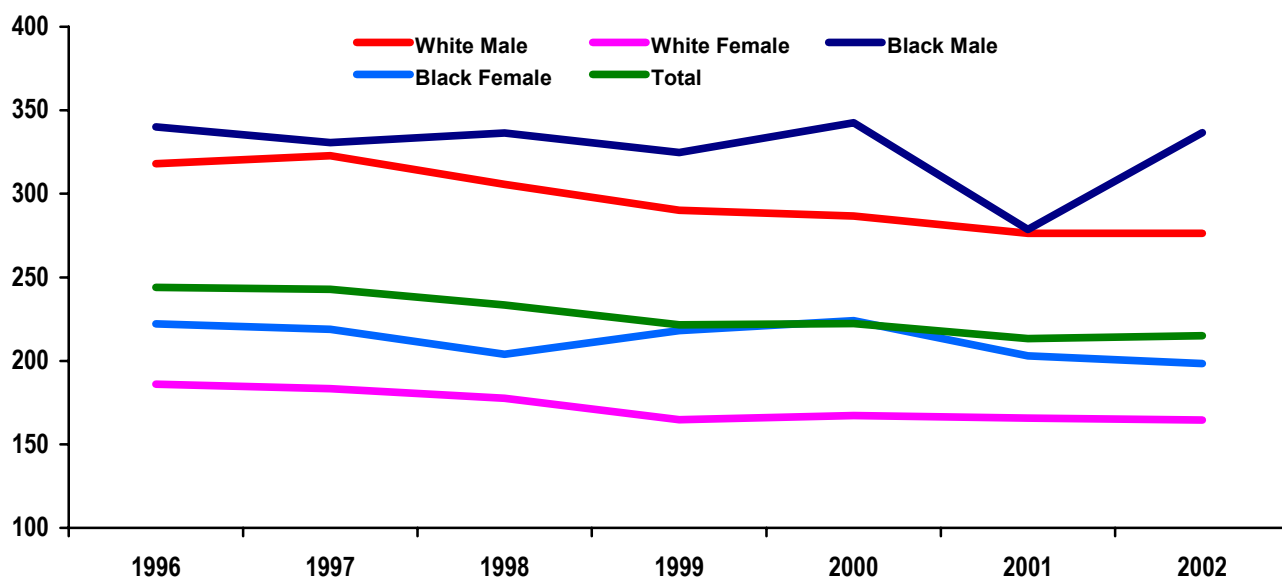


Figure 3.19. Trends in Age-adjusted Mortality Rate from Coronary Heart Disease, Total Population, 1996-2002, Tennessee, DSSS

Parallel mortality data for the age 65 and over population in Tennessee are presented in **Table 3.17**, and **Figure 3.20**. Approximately 10,000 people in this age group died from CHD in Tennessee annually, such that around 80% of the people who died from CHD each year were age 65 and over. Not surprisingly, the age-adjusted mortality rates from CHD for this age group were much higher than the rates for the general population. The age-adjusted mortality rates from CHD for the age 65 and over population in Tennessee decreased by 12% from 1,573.5 to 1,387.7 per 100,000 deaths during this time period.

As with the total Tennessee population, within the age 65 and over population age-adjusted mortality rates from CHD were consistently higher for Blacks compared to Whites (1,533.9/100,000 and 1,374.6/100,000, respectively, in 2002), and higher for men compared to women (1,761.7/100,000 and 1,157.4/100,000, respectively, in 2002). The race-gender pattern of CHD mortality rates for the age 65 and over population mirrors the pattern for the total population, with the highest rates for Black men (2,003.9/100,000 in 2002), followed by White men (1,742.5/100,000 in 2002), Black women (1,280.0/100,000 in 2002), and White women with the lowest (1,144.5/100,000 in 2002). As with the total population, the mortality rate from CHD for age 65 and over decreased the least for Black males (only 3%) during this time period.

Table 3.17. Number of Deaths and Age-adjusted Mortality Rate from Coronary Heart Disease, Age 65 and Over, 1996-2002, Tennessee, DSSS

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	4,082	4,231	4,142	3,937	3,948	3,832	3,901
White Female	4,872	4,903	4,802	4,576	4,629	4,625	4,677
Black Male	508	501	516	494	501	418	509
Black Female	689	684	667	694	705	641	645
Total White	8,954	9,134	8,944	8,513	8,577	8,457	8,578
Total Black	1,197	1,185	1,183	1,188	1,206	1,059	1,154
Total Male	4,598	4,742	4,666	4,434	4,452	4,258	4,420
Total Female	5,577	5,599	5,476	5,277	5,346	5,273	5,332
Total	10,175	10,341	10,142	9,711	9,798	9,531	9,752
Age-adjusted Rate Per 100,000							
White Male	1,999.5	2,039.1	1,940.3	1,829.2	1,809.3	1,744.9	1,742.5
White Female	1,305.2	1,286.1	1,239.1	1,165.5	1,170.3	1,147.5	1,144.5
Black Male	1,945.9	1,928.0	1,966.9	1,897.6	1,983.4	1,620.9	2,003.9
Black Female	1,426.9	1,400.2	1,348.2	1,407.5	1,433.2	1,327.4	1,280.0
Total White	1,570.7	1,570.3	1,510.4	1,419.8	1,416.0	1,377.5	1,374.6
Total Black	1,614.1	1,588.9	1,575.1	1,585.6	1,623.8	1,417.6	1,533.9
Total Male	1,987.7	2,022.4	1,936.9	1,830.0	1,819.7	1,724.7	1,761.7
Total Female	1,319.2	1,298.7	1,249.7	1,190.4	1,197.3	1,160.7	1,157.4
Total	1,573.5	1,570.5	1,514.3	1,433.9	1,434.0	1,377.1	1,387.7

Per 100,000

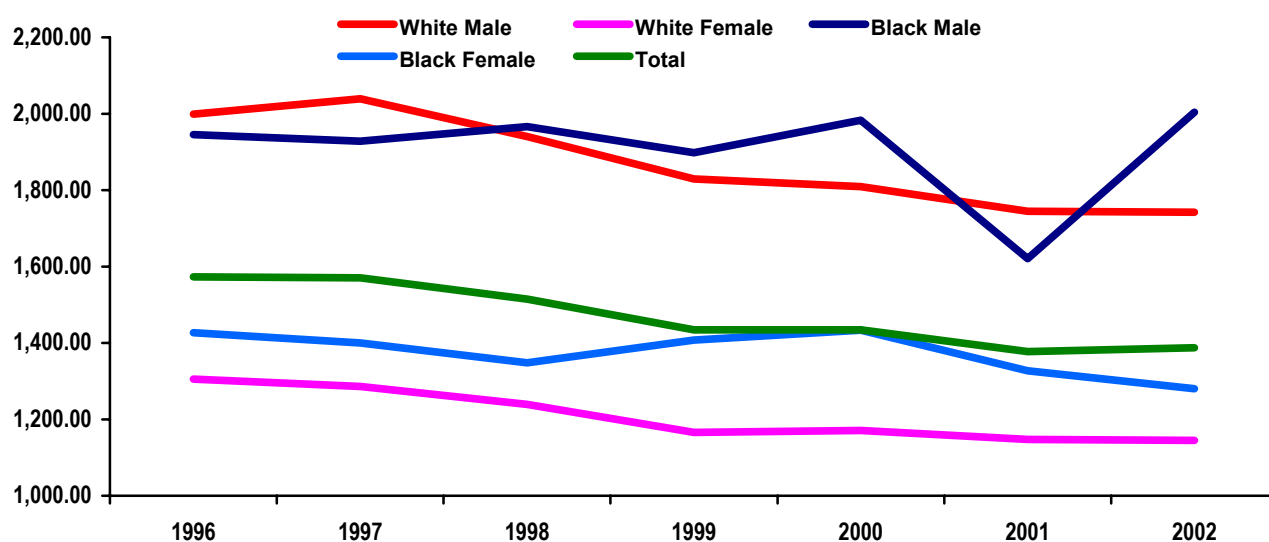


Figure 3.20. Trends in Age-adjusted Mortality Rate from Coronary Heart Disease, Age 65 and Over, 1996-2002, Tennessee, DSSS

Figure 3.21. is a map of the age-adjusted mortality rates from CHD by county for the total Tennessee population, based on DSSS data (five-year average, 1998-2002). **Figure 3.22.** is a map of the age-adjusted mortality rates from CHD by county for the age 65 and over population, based on DSSS data (five-year average, 1998-2002). The darker portions of the map reflect higher age-adjusted mortality rates from CHD.

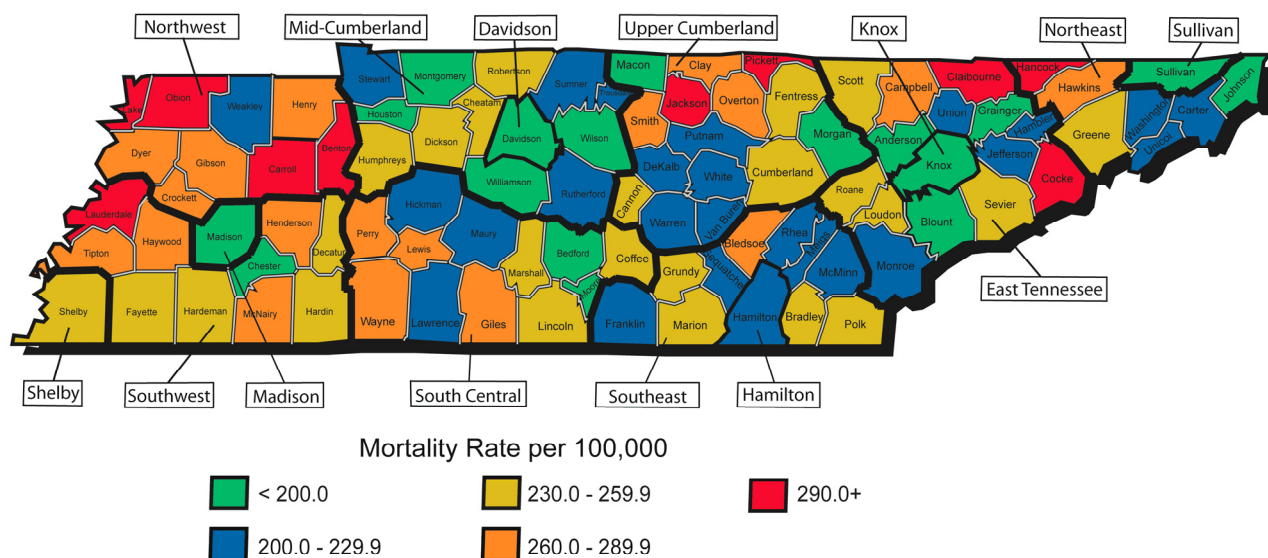


Figure 3.21. Average Age-adjusted Mortality Rate from Coronary Heart Disease by County and Health Service Region, Total Population, 1998-2002, Tennessee, DSSS

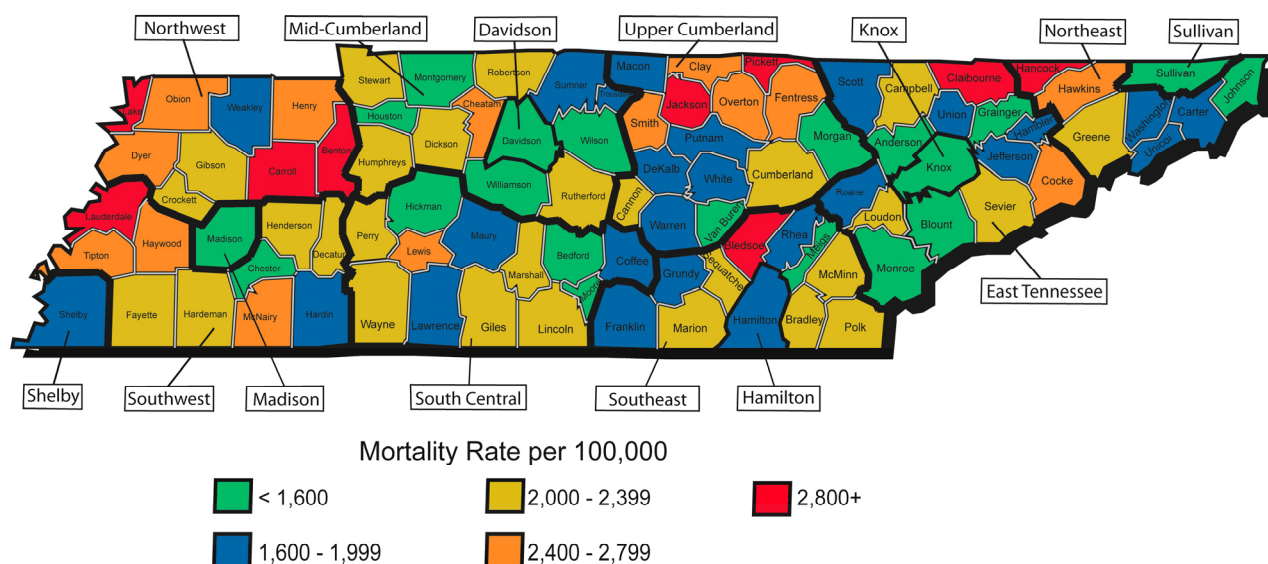


Figure 3.22. Average Age-adjusted Mortality Rate from Coronary Heart Disease by County and Health Service Region, Age 65 and Over, 1998-2002, Tennessee, DSSS

C. Myocardial Infarction (ICD-9-CM: 410) (ICD-10: I21 – I22)

Table 3.18. and **Figure 3.23.** present the frequencies for an item in the 2001 BRFSS, in which respondents reported whether they had ever been told by a doctor that they had a heart attack (or myocardial infarction, MI). According to the BRFSS data, 6% of the adult population in Tennessee reported that they had a physician-diagnosed heart attack. The prevalence of heart attack was higher for males (8.6) compared to females (3.7%), and higher for Whites (6.5%) compared to Blacks (4.1%). Thus, White men had the highest self-reported prevalence of heart attack (9.7%); however, Black women had the second highest prevalence (5.1%). White females had the next highest prevalence (3.6%), and Black males had the lowest (2.9%).

Table 3.18. Prevalence of Ever Having a Heart Attack in 2001, Tennessee, BRFSS

GROUP	TOTAL	MALE	FEMALE
Total	6.0%	8.6%	3.7%
White	6.5%	9.7%	3.6%
Black	4.1%	2.9%	5.1%

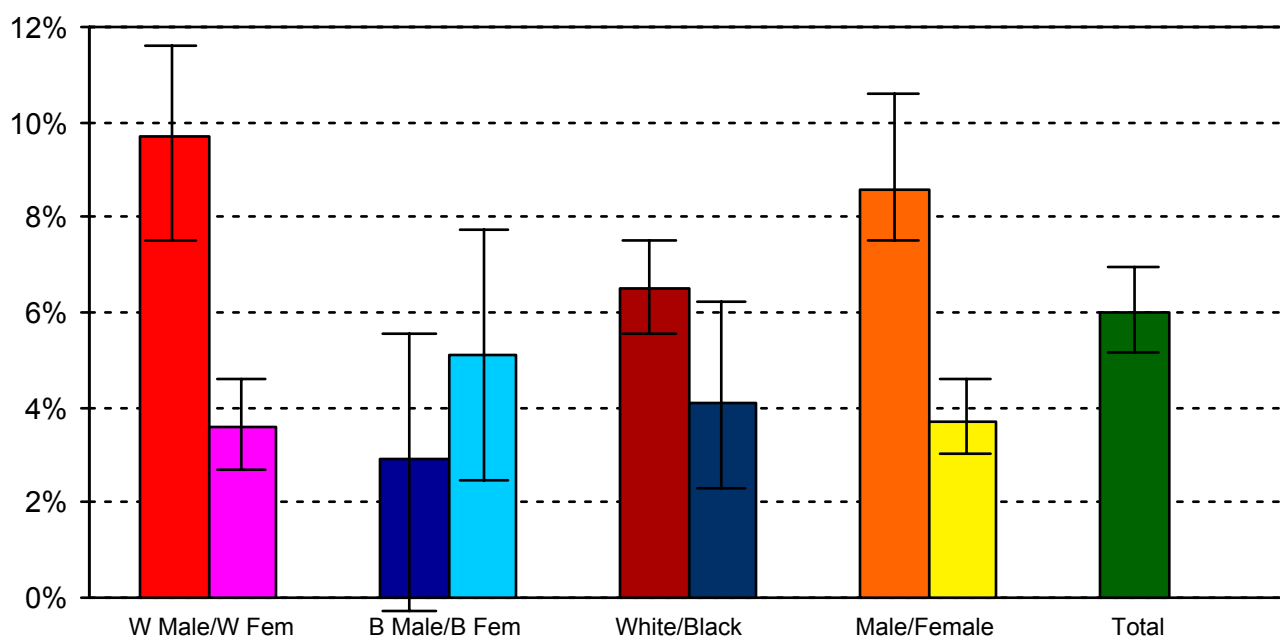


Figure 3.23. Prevalence of Heart Attack in 2001, Tennessee, BRFSS

Tables 3.19.-3.23. report the frequency and age-adjusted rates of MI as a primary diagnosis from several data sources: inpatient files from HDDS (all ages) and CMS (age 65 and over), outpatient files from HDDS and CMS, and carrier (physician) files from CMS (See Technical Notes in Appendix A). The tables report data for the state of Tennessee for the total sample (including all races), by race, by gender, and by race-gender groups, covering the period of 1997-2002 for HDDS and 1996-2002 for CMS. The trends for HDDS inpatient data and CMS inpatient data are also illustrated in **Figures 3.24.** and **3.25.**

According to the HDDS data, the number of inpatients in Tennessee with a primary diagnosis of MI increased by 11% from 13,011 in 1997 to 14,415 in 2002 (See **Table 3.19.**). However, the age-adjusted rates only increased by 3% from 239.8 to 245.8 per 100,000 population during this time period (See **Figure 3.24.**). This suggests that most of the raw increase in inpatients seen for MI was due to an aging population.

The age-adjusted rates of MI among inpatients were consistently almost twice as high for men compared to women. In 1997 the inpatient MI rate was higher for Blacks compared to Whites. However, the Black rate decreased by 18% compared to a 4% increase for Whites, such that Whites had higher rates after 1998. Thus, in 2002, White men had the highest age-adjusted rate of MI (322.6/100,000 in 2002), followed by Black men (248.5/100,000 in 2002), although the rate for Black men decreased by 22% from 1997 to 2002. Given that the age-adjusted inpatient rate of MI decreased by 14% for Black women, the rates for Black and White women virtually converged by 2002, with 166.6 and 166.0 per 100,000 population, respectively.

Table 3.19. Frequency and Age-adjusted Rate of Myocardial Infarction, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Frequencies						
White Male	6,655	6,703	6,946	6,863	6,810	7,240
White Female	4,228	4,349	4,405	4,716	4,589	4,903
Black Male	839	1,068	666	612	609	715
Black Female	728	812	728	660	583	678
Total White	10,884	11,054	11,355	11,580	11,399	12,143
Total Black	1,567	1,882	1,394	1,272	1,192	1,393
Total Male	7,834	8,315	8,087	8,057	8,106	8,481
Total Female	5,176	5,471	5,432	5,773	5,681	5,934
Total	13,011	13,790	13,523	13,831	13,787	14,415
Age-adjusted Rate Per 100,000						
White Male	321.1	317.7	322.2	317.1	306.9	322.6
White Female	153.4	154.6	154.7	164.2	157.6	166.0
Black Male	319.2	403.1	246.0	220.7	218.1	248.5
Black Female	193.2	210.4	188.1	168.9	147.0	166.6
Total White	229.2	228.5	230.8	233.1	226.0	237.2
Total Black	246.7	290.9	213.1	193.1	176.6	202.1
Total Male	332.5	345.8	330.3	326.9	321.0	331.8
Total Female	164.4	170.5	167.0	175.5	170.3	175.2
Total	239.8	249.3	240.5	243.5	238.7	245.8

Per 100,000

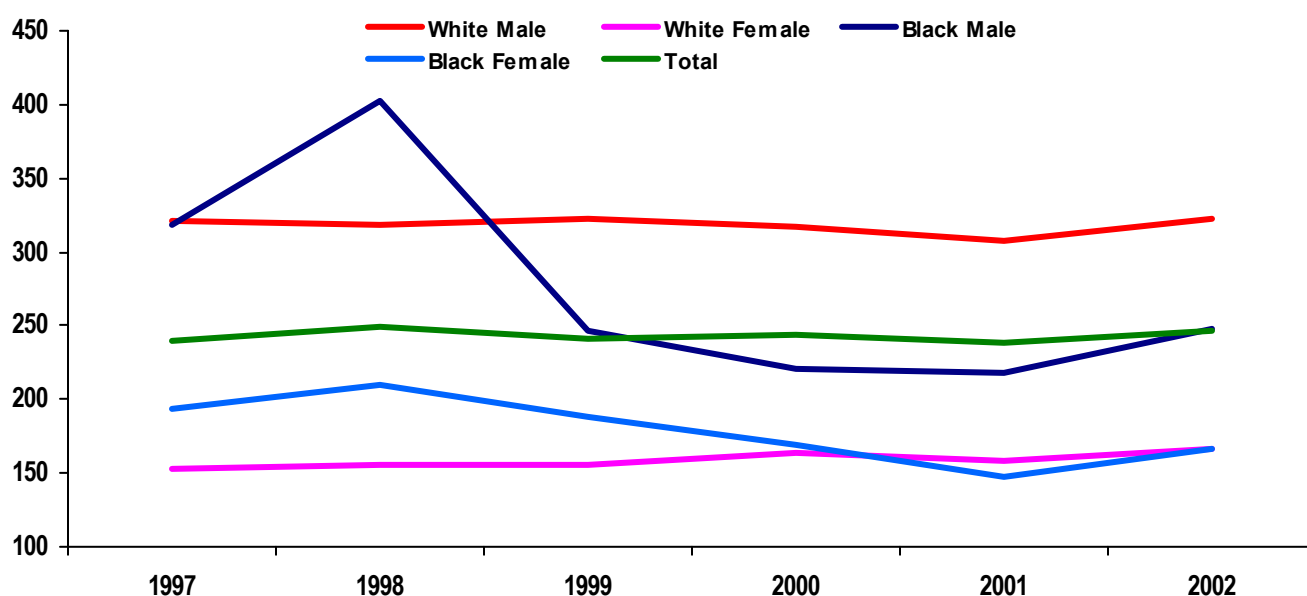


Figure 3.24. Trends in Age-adjusted Rate of Myocardial Infarction, 1997-2002, Tennessee, HDDS Inpatient Files

According to CMS data, the number of inpatients age 65 and over in Tennessee with a primary diagnosis of MI increased by 3% from 7,659 in 1996 to 7,855 in 2002 (See **Table 3.20.**). The age-adjusted rates of MI among inpatients were about four times higher for the 65 and over population (CMS) compared to the general population (HDDS). Disregarding the 1997 data anomaly, overall, the age-adjusted rates of MI among elderly inpatients decreased by 2% from 1,079.1 per 100,000 to 1,057.2 per 100,000 population from 1996 to 2002 (See **Figure 3.25.**). This suggests that most of the raw increase in inpatients seen for MI was due to an aging population.

The age-adjusted rates of MI among inpatients age 65 and over were consistently higher for men compared to women. In all years, the rate of MI was higher for elderly Whites compared to elderly Blacks, although the rates

started to converge somewhat given that the rate for Blacks increased by 14% and the rate for White decreased by 4% from 1996 to 2002. These same patterns persist when comparing elderly White men and Black men, but elderly Black women started with lower rates than White women in 1997 and surpassed them by 1999, although they fell just below White women in 2001 and 2002. Elderly white men had the highest age-adjusted rate of MI as inpatients in 2002 (1,350.2/100,000), and Black men had the second highest (956.8/100,000), followed by White women (901.2/100,000) and Black women (842.5/100,000).

Table 3.20. Frequency and Age-adjusted Rate of Myocardial Infarction, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	3,516	2,412	3,493	3,379	3,406	3,166	3,506
White Female	3,443	2,382	3,437	3,242	3,538	3,348	3,641
Black Male	248	140	247	248	231	238	262
Black Female	344	217	340	435	448	370	407
Total White	6,959	4,794	6,930	6,621	6,944	6,514	7,147
Total Black	592	357	587	683	679	608	669
Total Male	3,823	2,570	3,773	3,655	3,657	3,418	3,782
Total Female	3,836	2,636	3,822	3,722	4,013	3,746	4,073
Total	7,659	5,206	7,595	7,377	7,670	7,164	7,855
Age-adjusted Rate Per 100,000							
White Male	1,443.8	991.2	1,403.5	1,341.6	1,345.0	1,228.2	1,443.8
White Female	907.1	616.6	880.5	823.3	883.3	830.7	907.1
Black Male	898.5	504.3	880.8	912.0	841.2	874.9	898.5
Black Female	715.2	447.3	700.8	906.8	907.9	759.6	715.2
Total White	1,120.1	761.5	1,085.9	1,028.5	1,060.7	989.5	1,120.1
Total Black	778.8	466.9	771.5	907.0	884.9	798.8	778.8
Total Male	1,457.5	980.2	1,413.1	1,356.2	1,360.3	1,250.3	1,457.5
Total Female	929.1	629.6	903.5	873.6	934.9	863.7	929.1
Total	1,079.9	727.7	1,048.4	1,011.0	1,043.5	968.0	1,079.9

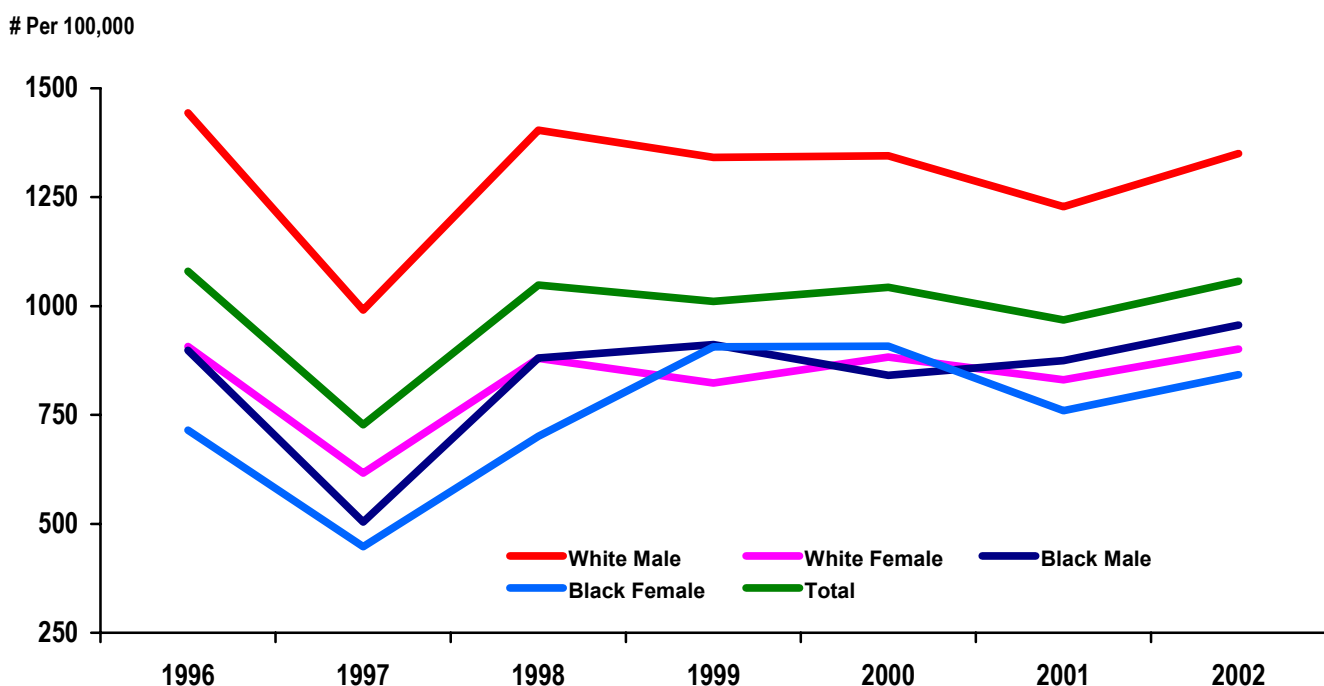


Figure 3.25. Trends in Age-adjusted Rate of Myocardial Infarction, 1996-2002, Tennessee, CMS Inpatient Files

According to the HDDS data, the number of outpatients in Tennessee with a primary diagnosis of MI increased by 114% from 1,425 in 1997 to 3,050 in 2002 (See **Table 3.21.**). However, the age-adjusted rates also increased by

97% from 26.1 to 51.4 per 100,000 population during this time period. This suggests that the raw increase in outpatients seen for MI was not merely due to an aging population.

The age-adjusted rates of MI among outpatients were consistently more than twice as high for men compared to women. In all years, the outpatient rate of MI was higher for Whites compared to Blacks, and the race difference in outpatient MI rates widened from 1997 to 2002 given that the rate for Whites increased by 106% and the rate for Blacks only increased by 26%. These same gender and race patterns persist when comparing the four race-gender subgroups. The rate for White females increased the fastest (121%) during this time period. White men had the highest age-adjusted rate of MI as outpatients in 2002 (75.4/100,000), and White women had the second highest (33.0/100,000), followed by Black men (30.4/100,000), and Black women had the lowest rate (16.8/100,000).

Table 3.21. Frequency and Age-adjusted Rate of Myocardial Infarction, 1997-2002, Tennessee, HDDS Outpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Frequencies						
White Male	812	1,245	1,185	1,341	1,490	1,771
White Female	406	616	601	720	761	946
Black Male	58	91	96	67	73	92
Black Female	58	58	69	67	46	70
Total White	1,218	1,861	1,786	2,061	2,251	2,717
Total Black	116	149	165	134	119	162
Total Female	497	697	690	845	872	1,075
Total Male	928	1,387	1,332	1,527	1,700	1,975
Total	1,425	2,084	2,022	2,372	2,572	3,050
Age-adjusted Rate Per 100,000						
White Male	38.2	56.9	53.1	59.3	64.4	75.4
White Female	14.9	22.5	21.5	25.7	26.8	33.0
Black Male	21.6	32.1	33.9	23.4	25.5	30.4
Black Female	15.2	14.8	17.7	17.0	11.7	16.8
Total White	25.5	38.3	36.2	41.3	44.4	52.8
Total Black	17.9	22.0	24.5	20.0	17.3	22.6
Total Male	16.0	22.2	21.5	26.1	26.6	32.5
Total Female	38.4	55.7	52.5	59.1	64.4	73.5
Total	26.1	37.4	35.7	41.3	44.0	51.4

According to CMS data, the number of outpatients age 65 and over in Tennessee with a primary diagnosis of MI stayed fairly stable, with 2,230 in 1996 to 2,220 in 2002 (See **Table 3.22.**). (Note: The number of MI cases in the CMS outpatient data is greater than in the HDDS outpatient data because not all facilities report to HDDS [e.g., VA facilities, non-hospital-affiliated outpatient clinics], while they all bill to CMS). The age-adjusted rates of MI among outpatients were much higher for the 65 and over population (CMS) compared to the general population (HDDS). Overall, the age-adjusted rates of MI among elderly outpatients decreased by 5% from 311.5 per 100,000 to 295.1 per 100,000 population from 1996 to 2002.

The age-adjusted rates of MI among outpatients age 65 and over were consistently higher for men compared to women, and higher for Whites compared to Blacks. In 2002, among the elderly population, White males had the highest age-adjusted rate of MI as outpatients (385.0/100,000 in 2002), followed by White females (257.2/100,000), Black males (219.7/100,000), and Black females with the lowest rate (153.4/100,000).

Table 3.22. Frequency and Age-adjusted Rate of Myocardial Infarction, 1996-2002, Tennessee, CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	1,044	901	1,144	1,052	972	943	1,042
White Female	1,024	1,256	1,049	969	961	954	1,036
Black Male	53	87	65	52	39	52	61
Black Female	80	150	74	95	87	72	74
Total White	2,068	2,157	2,193	2,021	1,933	1,897	2,078
Total Black	133	237	139	147	126	124	135
Total Male	1,115	1,003	1,217	1,114	1,014	1,001	1,106
Total Female	1,115	1,429	1,140	1,076	1,055	1,030	1,114
Total	2,230	2,432	2,357	2,190	2,069	2,031	2,220
Age-adjusted Rate Per 100,000							
White Male	421.1	348.0	444.0	409.5	368.3	354.8	385.0
White Female	269.1	322.3	268.8	245.7	240.5	237.3	257.2
Black Male	192.6	299.0	224.2	191.8	142.9	190.8	219.7
Black Female	168.1	309.4	149.9	198.5	184.4	148.2	153.4
Total White	329.7	331.3	340.7	312.3	292.7	286.0	309.7
Total Black	176.3	305.3	179.8	198.2	169.5	163.8	180.1
Total Male	418.7	364.6	444.5	406.8	365.3	358.3	388.3
Total Female	270.5	344.3	269.9	252.4	247.2	238.3	256.4
Total	311.5	329.1	322.8	298.8	279.5	272.8	295.1

According to CMS carrier (physician) data, the number of patients age 65 and over in Tennessee who were seen by a physician with a primary diagnosis of MI increased by 1% from 11,585 in 1996 to 11,717 in 2002 (See **Table 3.23**). Overall, the age-adjusted rates of physician-diagnosed MI among elderly patients decreased by 3% from 1,630.6 per 100,000 to 1,576.5 per 100,000 population from 1996 to 2002.

The age-adjusted rates of physician-diagnosed MI among the age 65 and over population were consistently higher for men compared to women, and higher for Whites compared to Blacks. In 2002, among the elderly population, White males had the highest age-adjusted rate of physician-diagnosed MI (1,934.7/100,000), followed by Black males (1,460.1/100,000), White females (1,385.6/100,000), and Black females with the lowest rate (1,269.5/100,000).

Table 3.23. Frequency and Age-adjusted Rate of Myocardial Infarction, 1996-2002, Tennessee, CMS Carrier Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	5,096	5,326	5,127	4,953	4,900	4,967	5,038
White Female	5,406	5,473	5,240	5,028	5,260	5,414	5,593
Black Male	382	386	386	355	343	367	404
Black Female	543	588	544	675	624	635	615
Total White	10,502	10,799	10,367	9,981	10,160	10,381	10,631
Total Black	925	974	930	1,030	967	1,002	1,019
Total Male	5,557	5,761	5,561	5,355	5,278	5,359	5,471
Total Female	6,028	6,121	5,863	5,770	5,933	6,082	6,246
Total	11,585	11,882	11,424	11,125	11,211	11,441	11,717
Age-adjusted Rate Per 100,000							
White Male	2,095.4	2,143.8	2,047.4	1,964.4	1,931.4	1,921.3	1,934.7
White Female	1,422.4	1,414.9	1,342.3	1,277.1	1,312.6	1,345.6	1,385.6
Black Male	1,366.0	1,380.5	1,380.8	1,323.0	1,245.6	1,341.0	1,460.1
Black Female	1,133.3	1,211.0	1,124.1	1,401.2	1,273.9	1,316.4	1,269.5
Total White	1,688.9	1,704.8	1,623.5	1,550.9	1,550.7	1,576.1	1,606.8
Total Black	1,212.7	1,271.7	1,222.9	1,371.9	1,266.8	1,324.1	1,347.0
Total Male	2,118.0	2,166.0	2,075.1	1,985.2	1,958.6	1,955.1	1,975.0
Total Female	1,460.5	1,463.1	1,386.1	1,354.9	1,383.0	1,405.6	1,426.1
Total	1,630.6	1,651.1	1,576.4	1,525.4	1,524.1	1,545.8	1,576.5

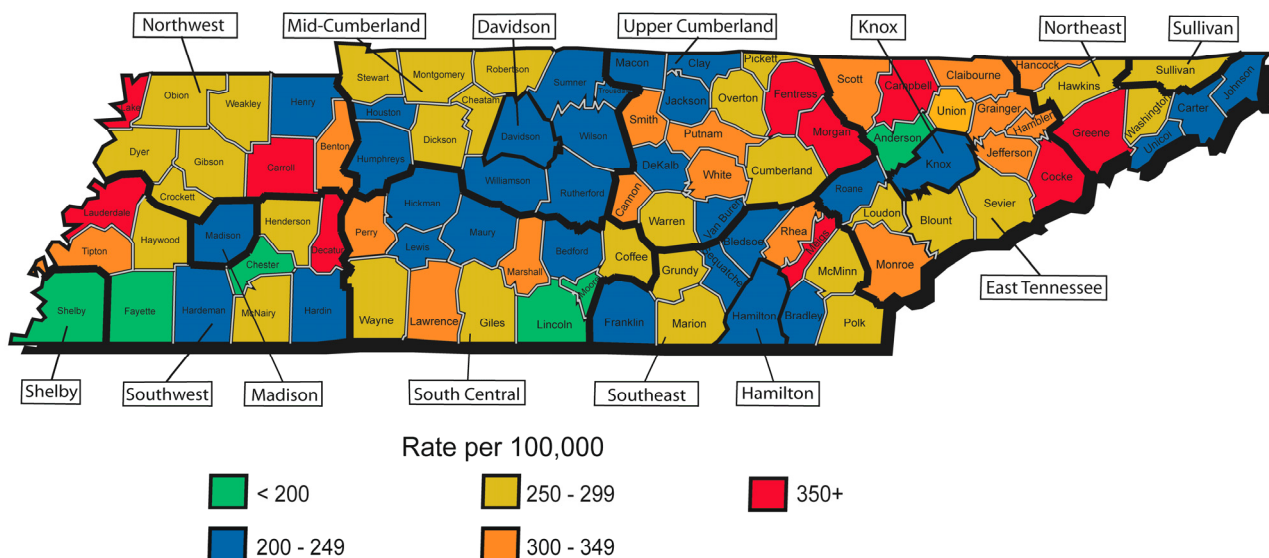


Figure 3.26. Average Age-adjusted Rate of Myocardial Infarction by County and Health Service Region, 1998-2002, Tennessee, HDDS Inpatient Files

Figure 3.26. is a map of the age-adjusted rates of MI by county, based on HDDS data (five-year average, 1998-2002). Figure 3.27. is a map of the age-adjusted rates of MI by county for the age 65 and over population, based on CMS data (five-year average, 1998-2002). The darker portions of the map reflect higher age-adjusted rates of MI.

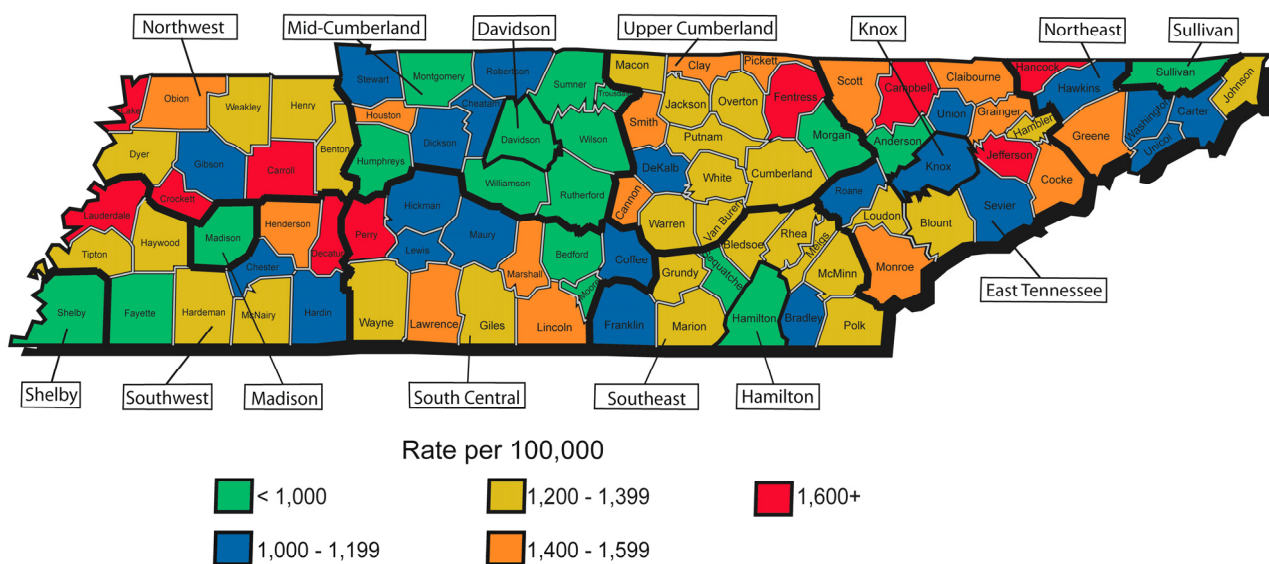


Figure 3.27. Average Age-adjusted Rate of Myocardial Infarction by County and Health Service Region, 1998-2002, Tennessee, CMS Inpatient Files

Table 3.24. reports the number of deaths and age-adjusted mortality rates from MI based on the Death Statistical System Summary (DSSS) for Tennessee from 1996 to 2002. The annual number of deaths from MI in Tennessee decreased by 9% from 1996 to 2002. With an average of about 5,500 deaths per year, MI accounted for just over one-third of all DOH deaths in Tennessee. The age-adjusted mortality rate from MI decreased by 17% from 111.3 to 92.1 per 100,000 deaths from 1996 to 2002 (See **Figure 3.28.**).

Men consistently had higher age-adjusted mortality rates from MI compared to women (121.1/100,000 and 71.2/100,000, respectively, in 2002), and the rates for Whites were slightly higher than the rates for Blacks during most years. Although White men had two and a half times higher rates of MI diagnoses in the HDDS inpatient

data compared to Black men, the mortality rate from MI for White men (123.0/100,000 in 2002) was only 11% higher than the mortality rate for Black men (110.9/100,000 in 2002). Black females had the third highest MI mortality rate (76.5/100,000 in 2002), and White females had the lowest (70.6/100,000 in 2002).

Table 3.24. Number of Deaths and Age-adjusted Mortality Rate from Myocardial Infarction, Total Population, 1996-2002, Tennessee, DSSS

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	2,714	2,858	2,690	2,558	2,507	2,438	2,440
White Female	2,414	2,341	2,317	2,206	2,207	2,226	2,229
Black Male	304	270	269	309	285	245	264
Black Female	331	346	331	320	341	314	311
Total White	5,128	5,199	5,007	4,764	4,714	4,664	4,669
Total Black	635	616	600	629	626	559	575
Total Male	3,027	3,138	2,968	2,872	2,796	2,691	2,711
Total Female	2,749	2,697	2,656	2,529	2,558	2,543	2,546
Total	5,776	5,835	5,624	5,401	5,354	5,234	5,257
Age-adjusted Rate Per 100,000							
White Male	150.3	156.0	141.7	134.5	129.7	124.9	123.0
White Female	84.4	80.1	78.1	73.1	72.5	72.1	70.6
Black Male	132.2	117.8	115.0	131.4	124.9	102.6	110.9
Black Female	87.5	90.0	85.0	82.6	86.9	80.3	76.5
Total White	112.4	111.5	105.1	98.7	96.6	94.3	92.9
Total Black	105.2	101.1	97.5	101.2	100.9	88.4	89.6
Total Male	147.8	151.5	138.4	133.7	128.6	122.0	121.1
Total Female	84.7	81.4	78.9	74.0	74.2	72.7	71.2
Total	111.3	110.2	104.1	98.6	96.7	93.2	92.1

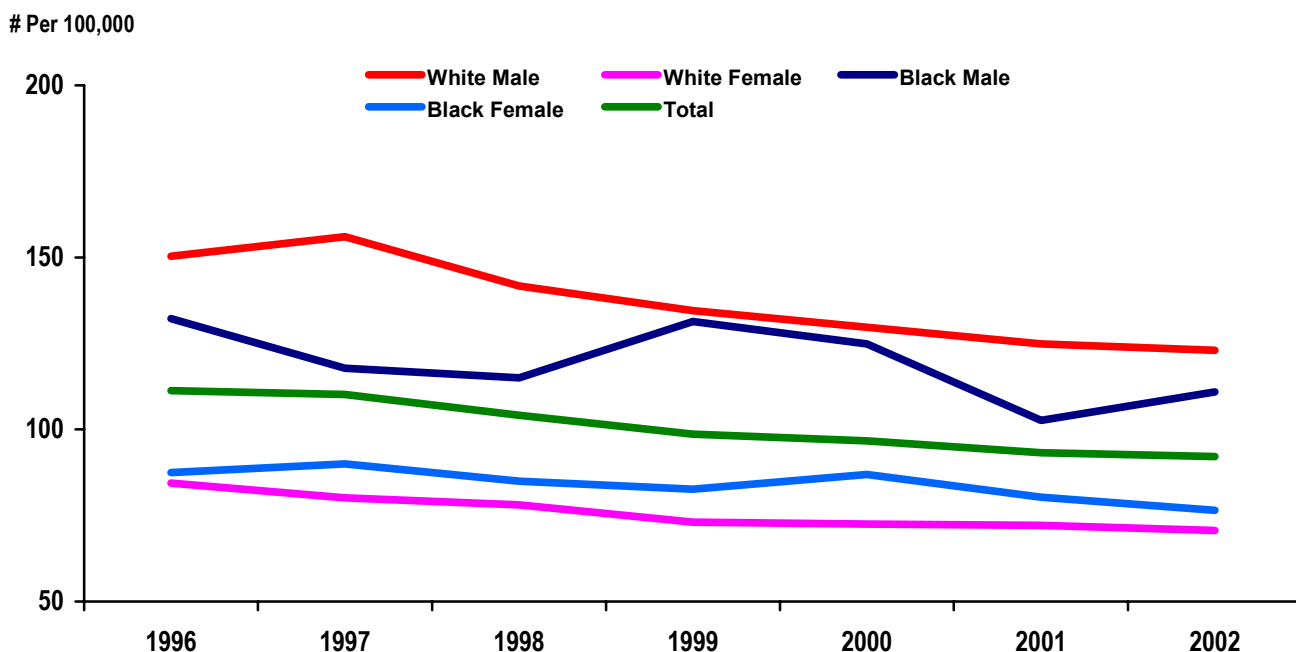


Figure 3.28. Trends in Age-adjusted Mortality Rate from Myocardial Infarction, Total Population, 1996-2002, Tennessee, DSSS

Parallel mortality data for the age 65 and over population in Tennessee are presented in **Table 3.25.** and **Figure 3.29.** Approximately 4,300 people in this age group died from MI in Tennessee annually, such that nearly 80% of the people who died from MI each year were age 65 and over. However, the MI death rates in this age group

declined by 9% from 1996 to 2002. Not surprisingly, the age-adjusted mortality rates from MI for this age group were much higher than the rates for the general population. The age-adjusted mortality rates from MI for the age 65 and over population in Tennessee decreased by 16% from 689.0 to 580.2 per 100,000 deaths during this time period.

As with the total Tennessee population, within the age 65 and over population, men consistently had higher age-adjusted mortality rates from MI compared to women (735.4/100,000 and 484.8/100,000, respectively, in 2002), and the rates for Whites were slightly higher than the rates for Blacks during most years. The race-gender pattern of MI mortality rates for the age 65 and over population mirrors the pattern for the total population, with the highest rates for White men (745.4/100,000 in 2002), followed by Black men (669.0/100,000 in 2002), Black women (495.7/100,000 in 2002), and White women with the lowest (484.2/100,000 in 2002).

Table 3.25. Number of Deaths and Age-adjusted Mortality Rate from Myocardial Infarction, Age 65 and Over, 1996-2002, Tennessee, DSSS

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	1,875	2,006	1,885	1,789	1,744	1,675	1,685
White Female	2,125	2,070	2,025	1,963	1,945	1,939	1,970
Black Male	208	184	178	206	189	162	168
Black Female	267	281	272	263	269	247	250
Total White	4,000	4,076	3,910	3,752	3,689	3,614	3,655
Total Black	475	465	450	469	458	409	418
Total Male	2,087	2,198	2,070	1,997	1,935	1,840	1,858
Total Female	2,396	2,359	2,301	2,229	2,221	2,188	2,225
Total	4,483	4,557	4,371	4,226	4,156	4,028	4,083
Age-adjusted Rate Per 100,000							
White Male	893.5	944.1	856.5	817.8	786.1	753.5	745.4
White Female	572.4	546.3	527.2	504.4	495.6	485.4	484.2
Black Male	786.9	704.1	676.0	794.0	757.2	629.2	669.0
Black Female	552.9	576.4	552.1	539.8	546.3	513.1	495.7
Total White	696.4	696.0	656.0	622.8	606.9	587.4	584.8
Total Black	640.4	623.2	600.2	628.0	616.5	549.3	554.7
Total Male	879.3	917.9	836.3	813.4	781.4	737.5	735.4
Total Female	569.7	550.4	529.6	507.1	500.6	485.6	484.8
Total	689.0	688.3	649.4	621.6	606.7	581.2	580.2

Per 100,000

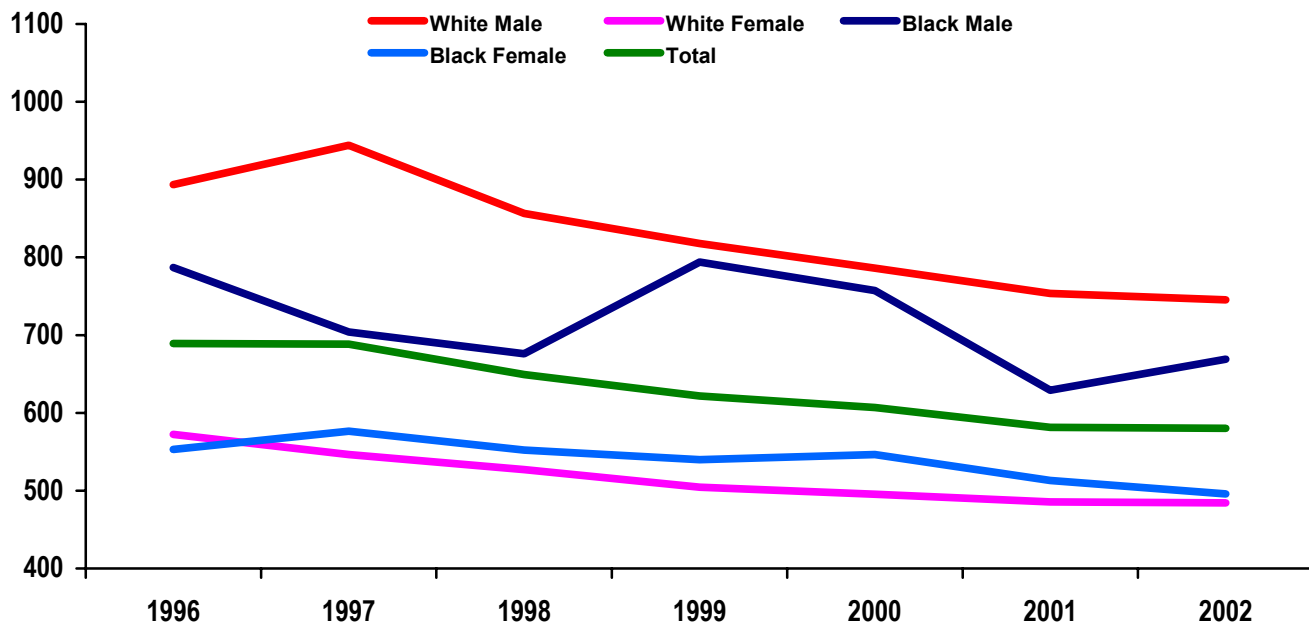


Figure 3.29. Trends in Age-adjusted Mortality Rate from Myocardial Infarction, Age 65 and Over, 1996-2002, Tennessee, DSSS

Figure 3.30. is a map of the age-adjusted mortality rates from MI by county for the total Tennessee population, based on DSSS data (five-year average, 1998-2002). **Figure 3.31.** is a map of the age-adjusted mortality rates from MI by county for the age 65 and over population, based on DSSS data (five-year average, 1998-2002). The darker portions of the map reflect higher age-adjusted mortality rates from MI.

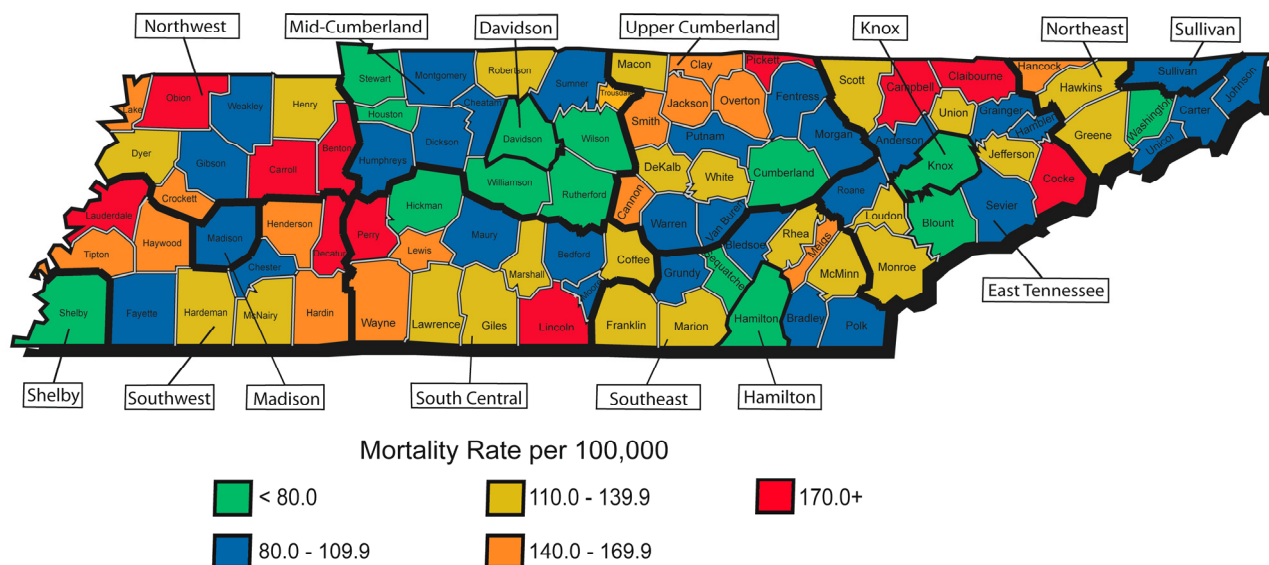


Figure 3.30. Average Age-adjusted Mortality Rate from Myocardial Infarction by County and Health Service Region, Total Population, 1998-2002, Tennessee, DSSS

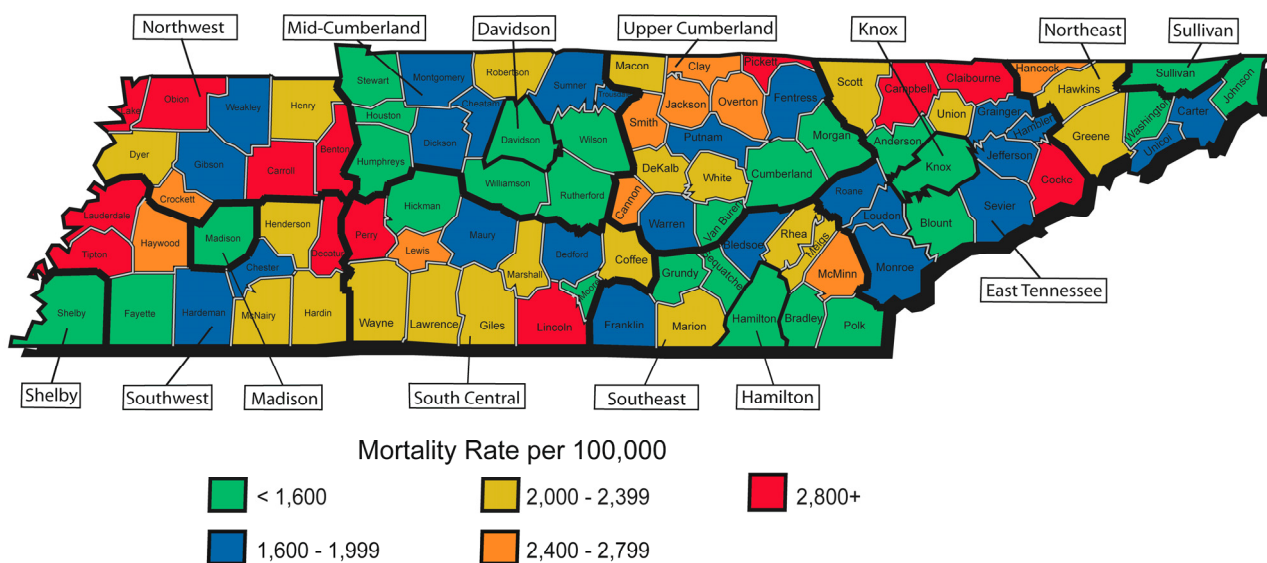


Figure 3.31. Average Age-adjusted Mortality Rate from Myocardial Infarction by County and Health Service Region, Age 65 and Over, 1998-2002, Tennessee, DSSS

D. Congestive Heart Failure (ICD-9-CM: 428.0) (ICD-10: I50.0)

Tables 3.26-3.30. report the frequency and age-adjusted rates of congestive heart failure (CHF) as a primary diagnosis from several data sources: inpatient files from HDDS (all ages) and CMS (age 65 and over), outpatient files from HDDS and CMS, and carrier (physician) files from CMS (See Technical Notes in Appendix A). The tables report data for the state of Tennessee for the total sample (including all races), by race, by gender, and by race-gender groups, covering the period of 1997-2002 for HDDS and 1996-2002 for CMS. The trends for HDDS inpatient data and CMS inpatient data are also illustrated in **Figures 3.32.** and **3.33.**

According to the HDDS data, the number of inpatients in Tennessee with a primary diagnosis of CHF increased by 15% from 15,526 in 1997 to 17,601 in 2002 (See **Table 3.26.**). However, the age-adjusted rates only increased by 7% from 285.6 to 305.1 per 100,000 population during this time period (See **Figure 3.32.**). This suggests that some of the raw increase in inpatients seen for CHF was due to an aging population.

The age-adjusted rates of CHF among inpatients were consistently higher for men compared to women, and substantially higher for Blacks compared to Whites across the years. Black men had the highest age-adjusted rate of CHF in most years, although their rate decreased by 6% from 1997 to 2002 to where it converged with the rate of Black women (489.2/100,000 and 489.6/100,000, respectively, in 2002). White men had slightly higher age-adjusted rates of CHF than White women (282.0/100,000 and 252.3/100,000, respectively, in 2002), although the rates for White women increased by 13% from 1997 to 2002.

Table 3.26. Frequency and Age-adjusted Rate of Congestive Heart Failure, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Frequencies						
White Male	5,057	5,262	5,410	5,612	5,425	5,737
White Female	6,425	6,803	6,980	7,350	7,412	7,645
Black Male	1,305	1,416	1,239	1,157	1,206	1,381
Black Female	1,868	2,029	1,887	1,615	1,674	2,012
Total White	11,484	12,068	12,392	12,963	12,837	13,382
Total Black	3,173	3,447	3,126	2,773	2,880	3,393
Total Male	6,620	7,073	6,948	7,273	7,200	7,499
Total Female	8,634	9,246	9,209	9,516	9,820	10,102
Total	15,256	16,324	16,159	16,791	17,020	17,601
Age-adjusted Rate Per 100,000						
White Male	272.8	278.2	280.0	286.3	271.6	282.0
White Female	224.3	233.9	237.7	248.7	247.8	252.3
Black Male	520.5	551.6	464.1	432.2	437.2	489.2
Black Female	488.0	521.8	479.4	407.2	419.1	489.9
Total White	244.6	252.3	255.2	264.1	257.6	264.1
Total Black	501.5	534.6	474.8	418.1	425.2	492.2
Total Male	311.2	325.2	313.0	324.3	314.6	320.6
Total Female	267.5	282.3	278.1	284.6	290.1	294.7
Total	285.6	299.9	292.5	300.7	300.2	305.1

According to CMS data, the number of inpatients age 65 and over in Tennessee with a primary diagnosis of CHF increased by 5% from 12,051 in 1996 to 12,598 in 2002 (See **Table 3.27.**). The age-adjusted rates of CHF among inpatients were more than five times higher for the 65 and over population (CMS) compared to the general population (HDDS). Overall, disregarding the data anomaly in 1997, the age-adjusted rates of CHF among elderly inpatients decreased by 2% from 1,751.0 per 100,000 to 1714.5 per 100,000 population from 1996 to 2002 (See **Figure 3.33.**). This suggests that most of the raw increase in inpatients seen for CHF was due to an aging population.

Per 100,000

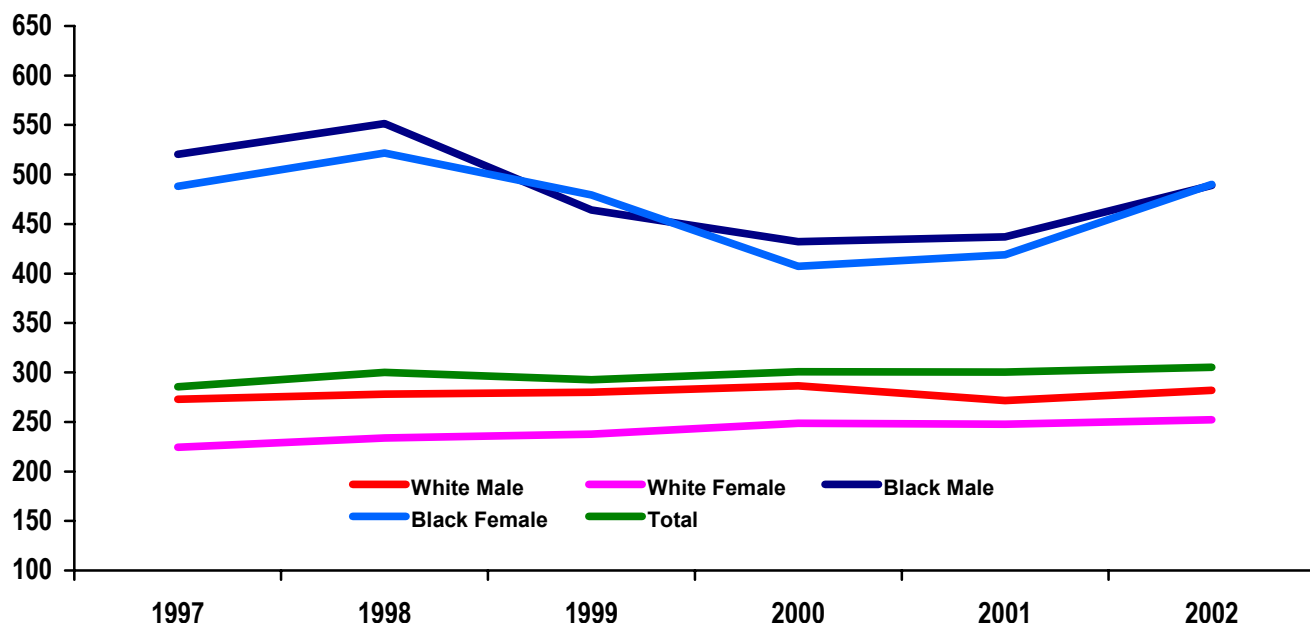


Figure 3.32. Trends in Age-adjusted Rate of Congestive Heart Failure, 1997-2002, Tennessee, HDDS Inpatient Files

The age-adjusted rates of CHF among inpatients age 65 and over were consistently higher for men compared to women. For all years, the rate of CHF was considerably higher for Blacks compared to Whites, especially since the rate for Blacks increased by 12% compared to a 4% decrease among Whites from 1996 to 2002. Black females had the highest age-adjusted rate of CHF, followed by Black males (2,468.7/100,000 and 2,169.4/100,000, respectively, in 2002). White men had higher age-adjusted rates of CHF than White women (1,741.7/100,000 and 1,592.0/100,000, respectively, in 2002).

Table 3.27. Frequency and Age-adjusted Rate of Congestive Heart Failure, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	4,194	3,056	4,199	4,110	4,328	3,949	4,264
White Female	6,081	4,370	6,183	6,185	6,411	6,206	6,463
Black Male	561	353	602	561	581	561	598
Black Female	1,049	649	1,151	1,150	1,058	1,026	1,202
Total White	10,275	7,426	10,382	10,295	10,739	10,155	10,727
Total Black	1,610	1,002	1,753	1,711	1,639	1,587	1,800
Total Male	4,804	3,439	4,840	4,717	4,940	4,533	4,885
Total Female	7,247	5,075	7,413	7,425	7,547	7,275	7,713
Total	12,051	8,514	12,253	12,142	12,487	11,808	12,598
Age-adjusted Rate Per 100,000							
White Male	1,895.5	1,374.4	1,826.5	1,756.6	1,816.6	1,632.2	1,741.7
White Female	1,604.3	1,128.1	1,577.8	1,564.2	1,591.3	1,533.1	1,592.0
Black Male	2,032.5	1,292.8	2,206.5	2,072.2	2,107.3	2,075.7	2,169.4
Black Female	2,161.3	1,327.4	2,366.8	2,374.0	2,149.7	2,099.5	2,468.7
Total White	1,717.0	1,220.4	1,672.7	1,638.7	1,668.8	1,569.2	1,646.9
Total Black	2,109.4	1,314.5	2,302.0	2,252.5	2,130.7	2,086.8	2,363.7
Total Male	1,961.1	1,402.2	1,921.6	1,845.9	1,916.2	1,733.4	1,840.0
Total Female	1,741.7	1,198.6	1,734.4	1,726.0	1,741.7	1,663.8	1,744.6
Total	1,751.0	1,224.3	1,729.9	1,696.1	1,721.1	1,617.5	1,714.4

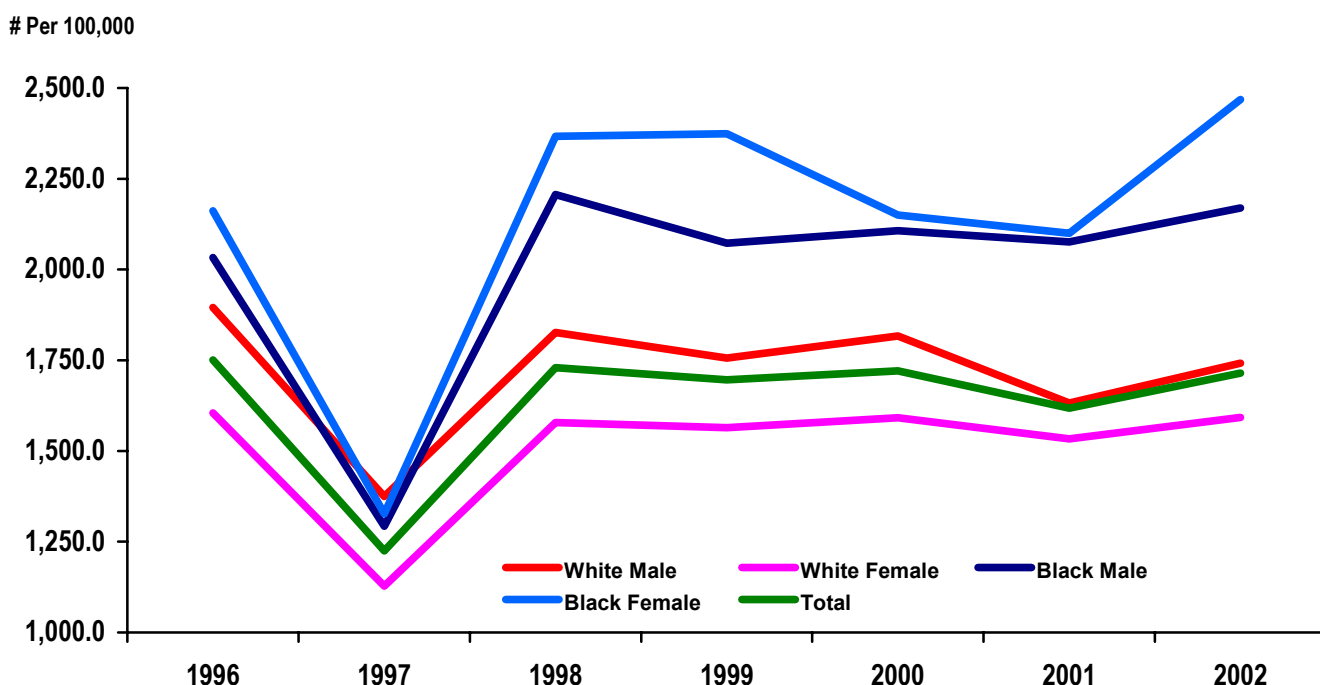


Figure 3.33. Trends in Age-adjusted Rate of Congestive Heart Failure, 1996-2002, Tennessee, CMS Inpatient Files

According to the HDDS data, the number of outpatients in Tennessee with a primary diagnosis of CHF increased by 55% from 3,513 in 1997 to 5,450 in 2002 (See **Table 3.28.**). However, the age-adjusted rates also increased by 43% from 65.3 to 93.6 per 100,000 population during this time period. This suggests that the raw increase in outpatients seen for CHF was not merely due to an aging population.

The age-adjusted rates of CHF among outpatients were slightly higher for men compared to women. For all years, the rate of CHF was considerably higher for Blacks compared to Whites, in spite of the fact that the rate for Whites increased by 62% from 1997 to 2002 while the rate for Blacks stayed flat. Black males had slightly higher age-adjusted rates of CHF as outpatients than Black females in most years (153.5/100,000 and 148.1/100,000, respectively, in 2002). White men had slightly higher age-adjusted rates of CHF as outpatients than White women (86.5/100,000 and 78.9/100,000, respectively, in 2002).

Table 3.28. Frequency and Age-adjusted Rate of Congestive Heart Failure, 1997-2002, Tennessee, HDDS Outpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Frequencies						
White Male	1,030	1,507	1,413	1,815	1,789	1,846
White Female	1,368	1,901	1,859	2,374	2,356	2,334
Black Male	391	502	398	432	412	464
Black Female	566	684	565	617	577	622
Total White	2,398	3,410	3,272	4,189	4,145	4,180
Total Black	957	1,186	964	1,049	989	1,086
Total Male	1,491	2,114	1,916	2,375	2,335	2,402
Total Female	2,022	2,725	2,545	3,124	3,106	3,048
Total	3,513	4,841	4,462	5,499	5,441	5,450

Table 3.28. Continued

GROUP	1997	1998	1999	2000	2001	2002
Age-adjusted Rate Per 100,000						
White Male	54.2	77.6	70.7	89.7	85.8	86.5
White Female	48.7	66.6	64.3	82.2	80.2	78.9
Black Male	153.5	188.9	143.0	154.5	140.9	153.5
Black Female	148.7	174.4	142.4	153.1	141.2	148.1
Total White	50.8	71.1	67.1	85.0	82.7	82.1
Total Black	150.1	180.7	144.0	153.0	140.1	150.8
Total Male	68.3	94.0	82.9	102.2	97.5	98.0
Total Female	63.7	84.6	77.8	95.2	93.3	90.5
Total	65.3	88.4	80.2	97.7	95.0	93.6

According to CMS data, the number of outpatients age 65 and over in Tennessee with a primary diagnosis of CHF decreased by 3% from 19,312 in 1996 to 18,668 in 2002 (See **Table 3.29.**). (Note: The number of CHF cases in the CMS outpatient data is greater than in the HDDS outpatient data because not all facilities report to HDDS [e.g., VA facilities, non-hospital-affiliated outpatient clinics], while they all bill to CMS). The age-adjusted rates of CHF among outpatients were much higher for the 65 and over population (CMS) compared to the general population (HDDS). Overall, the age-adjusted rates of CHF among elderly outpatients decreased by 10% from 2,848.1 per 100,000 to 2,552.6 per 100,000 population from 1996 to 2002.

The age-adjusted rates of CHF among outpatients age 65 and over were slightly higher for women compared to men, and just slightly higher for Whites compared to Blacks. In 2002, among the elderly population, Black females had the highest age-adjusted rate of CHF as outpatients (2,690.8/100,000 in 2002), followed by White females (2,555.0/100,000), White males (2,535.5/100,000), and Black males with the lowest rate (2,294.0/100,000).

Table 3.29. Frequency and Age-adjusted Rate of Congestive Heart Failure, 1996-2002, Tennessee, CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	5,914	7,839	7,008	6,604	6,537	6,222	6,199
White Female	11,100	11,539	12,929	11,734	11,546	11,123	10,424
Black Male	661	658	749	692	684	675	627
Black Female	1,368	1,256	1,523	1,468	1,427	1,340	1,311
Total White	17,014	19,378	19,937	18,338	18,083	17,345	16,623
Total Black	2,029	1,914	2,272	2,160	2,111	2,015	1,938
Total Male	6,653	8,561	7,820	7,347	7,254	6,930	6,865
Total Female	12,659	12,993	14,627	13,363	13,074	12,536	11,803
Total	19,312	21,554	22,447	20,710	20,328	19,466	18,668
Age-adjusted Rate Per 100,000							
White Male	2,785.2	3,021.8	3,125.0	2,870.6	2,779.6	2,603.7	2,535.5
White Female	2,932.0	2,967.9	3,289.9	2,952.0	2,856.2	2,730.8	2,555.0
Black Male	2,451.2	2,271.7	2,775.9	2,589.9	2,537.8	2,528.5	2,294.0
Black Female	2,804.5	2,593.2	3,097.6	3,008.2	2,875.2	2,741.1	2,690.8
Total White	2,889.1	2,988.5	3,247.7	2,941.8	2,827.4	2,698.1	2,563.8
Total Black	2,674.8	2,471.3	2,987.1	2,852.2	2,757.3	2,654.0	2,555.8
Total Male	2,804.6	3,115.2	3,166.6	2,913.8	2,846.6	2,681.8	2,597.2
Total Female	3,030.3	3,130.0	3,395.5	3,079.1	2,996.9	2,840.0	2,644.7
Total	2,848.1	2,930.6	3,201.3	2,914.7	2,820.2	2,681.6	2,552.6

According to CMS carrier (physician) data, the number of patients age 65 and over in Tennessee who were seen by a physician with a primary diagnosis of CHF increased by 4% from 58,828 in 1996 to 60,916 in 2002 (See **Table 3.30**). Overall, the age-adjusted rates of physician-diagnosed CHF among elderly patients decreased by 3% from 8,595.7 per 100,000 to 8,305.5 per 100,000 population from 1996 to 2002.

The age-adjusted rates of physician-diagnosed CHF among the age 65 and over population were slightly higher for men compared to women in most years, and consistently higher for Blacks compared to Whites. In 2002, among the elderly population, Black females had the highest age-adjusted rate of physician-diagnosed CHF (10,283.5/100,000), followed by Black males (8,929.8/100,000), White males (8,411.4/100,000), and White females with the lowest rate (7,979.0/100,000).

Table 3.30. Frequency and Age-adjusted Rate of Congestive Heart Failure, 1996-2002, Tennessee, CMS Carrier Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	18,874	20,350	20,260	20,007	20,377	20,606	20,676
White Female	31,661	33,365	32,747	32,086	32,193	33,158	32,433
Black Male	2,439	2,634	2,565	2,369	2,443	2,421	2,426
Black Female	5,070	5,381	5,243	4,980	4,977	4,883	5,016
Total White	50,535	53,715	53,007	52,093	52,570	53,764	53,109
Total Black	7,509	8,015	7,808	7,349	7,420	7,304	7,442
Total Male	21,548	23,156	23,019	22,590	22,956	23,148	23,226
Total Female	37,280	39,185	38,494	37,549	37,472	38,300	37,690
Total	58,828	62,341	61,513	60,139	60,428	61,448	60,916
Age-adjusted Rate Per 100,000							
White Male	8,632.7	9,056.0	8,818.9	8,570.2	8,547.0	8,516.8	8,411.4
White Female	8,356.1	8,617.8	8,352.3	8,098.1	7,987.5	8,169.7	7,979.0
Black Male	9,032.9	9,758.6	9,508.7	8,827.6	9,014.7	8,971.4	8,929.8
Black Female	10,408.3	10,964.0	10,703.0	10,165.3	10,053.1	9,951.0	10,283.5
Total White	8,483.7	8,810.6	8,561.5	8,299.9	8,176.4	8,315.8	8,160.7
Total Black	9,904.8	10,520.7	10,284.1	9,691.9	9,686.8	9,599.2	9,813.3
Total Male	8,894.2	9,388.5	9,155.9	8,853.0	8,916.6	8,864.1	8,746.7
Total Female	8,950.1	9,261.2	8,983.4	8,700.0	8,635.2	8,728.3	8,500.3
Total	8,595.7	8,953.1	8,712.5	8,414.5	8,344.6	8,425.5	8,305.5

Figure 3.34. is a map of the age-adjusted rates of CHF by county, based on HDDS data (five-year average, 1998-2002). **Figure 3.35.** is a map of the age-adjusted rates of CHF by county for the age 65 and over population, based on CMS data (five-year average, 1998-2002). The darker portions of the map reflect higher age-adjusted rates of CHF.

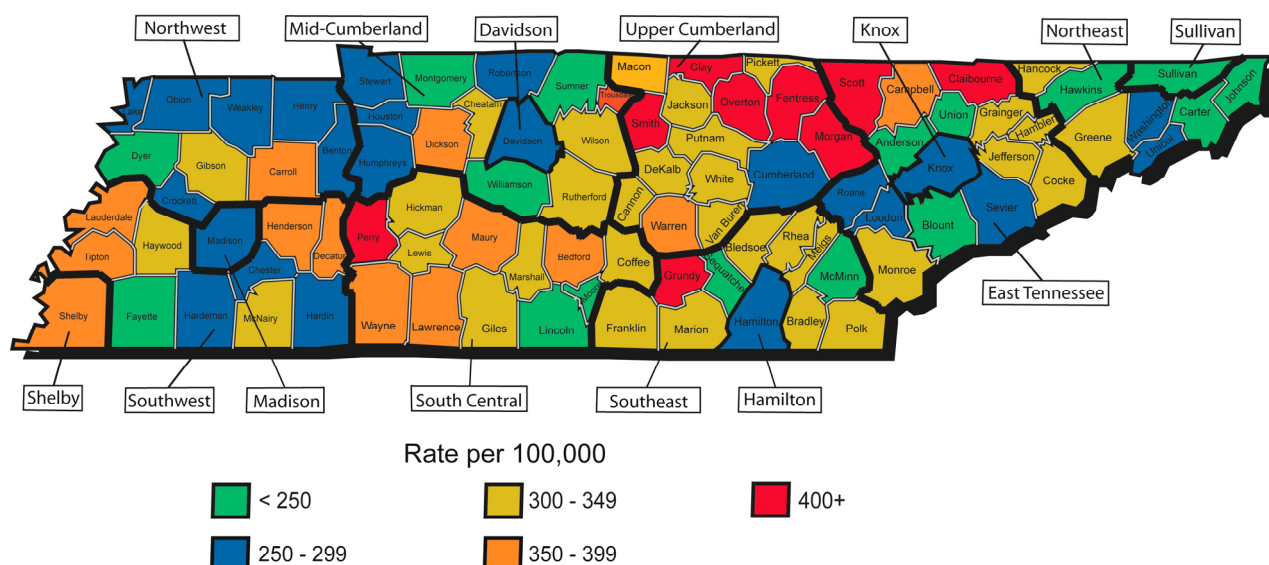


Figure 3.34. Average Age-adjusted Rate of Congestive Heart Failure by County and Health Service Region, 1998-2002, Tennessee, HDDS Inpatient Files

Table 3.31. Continued

GROUP	1996	1997	1998	1999	2000	2001	2002
Age-adjusted Rate Per 100,000							
White Male	9.2	8.1	9.8	15.7	12.0	8.7	9.8
White Female	7.6	7.6	9.4	13.6	10.8	7.8	8.7
Black Male	8.3	15.0	9.2	19.1	16.4	11.1	8.8
Black Female	8.4	8.1	11.7	17.5	11.9	9.4	5.3
Total White	8.1	7.8	9.5	14.5	11.2	8.3	9.2
Total Black	8.4	10.6	10.8	18.1	13.2	9.9	6.5
Total Male	9.0	8.8	9.7	16.1	12.6	9.0	9.6
Total Female	7.6	7.6	9.7	14.0	11.0	8.0	8.4
Total	8.1	8.1	9.7	14.9	11.4	8.5	8.9

Per 100,000

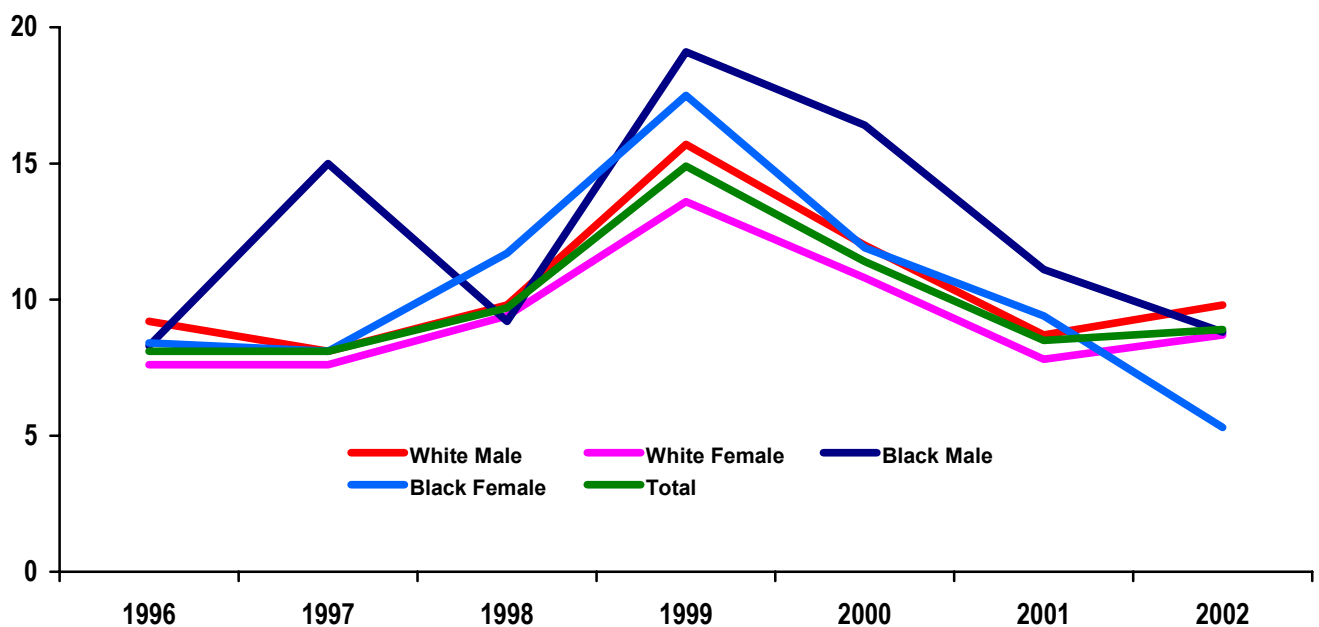


Figure 3.36. Trends in Age-adjusted Mortality Rate from Congestive Heart Failure, Total Population, 1996-2002, Tennessee, DSSS

Parallel mortality data for the age 65 and over population in Tennessee are presented in **Table 3.32.** and **Figure 3.37.** With an average of about 500 deaths per year in this age group, the vast majority of the people who died from CHF each year were age 65 and over. Hence, the CHF death rates in this age group also increased by 22% from 1996 to 2002. Not surprisingly, the age-adjusted mortality rates from CHF for this age group were much higher than the rates for the general population. The age-adjusted mortality rates from CHF for the age 65 and over population in Tennessee increased by 8% from 60.0 to 64.5 per 100,000 deaths during this time period.

As with the total Tennessee population, within the age 65 and over population, men had higher age-adjusted mortality rates from CHF compared to women in most years (68.8/100,000 and 61.6/100,000, respectively, in 2002). However, mortality trends by race and race-gender were less consistent across years, as was seen with the general population. In 2002, CHF mortality rates for the age 65 and over population were highest for White men (70.5/100,000 in 2002), followed by White women (65.0/100,000 in 2002), Black men (58.8/100,000 in 2002), and Black women were lowest (33.8/100,000 in 2002).

Table 3.32. Number of Deaths and Age-adjusted Mortality Rate from Congestive Heart Failure, Age 65 and Over, 1996-2002, Tennessee, DSSS

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	126	116	139	228	175	132	149
White Female	214	220	272	410	322	239	270
Black Male	14	24	13	28	28	17	14
Black Female	27	28	40	55	42	34	17
Total White	340	336	411	638	497	371	419
Total Black	41	52	53	83	70	51	31
Total Male	140	140	152	256	206	151	163
Total Female	241	248	313	465	366	273	288
Total	381	388	465	721	572	424	451
Age-adjusted Rate Per 100,000							
White Male	69.8	61.2	72.5	114.5	90.3	63.9	70.5
White Female	56.8	56.9	69.5	102.8	80.1	57.9	65.0
Black Male	53.8	95.8	53.0	113.1	116.4	71.3	58.8
Black Female	55.4	55.8	78.8	112.0	86.1	69.1	33.8
Total White	61.0	58.8	70.3	107.7	83.2	61.0	67.5
Total Black	55.7	69.2	69.5	111.2	94.3	68.2	41.8
Total Male	66.9	64.9	70.5	113.9	93.9	65.0	68.8
Total Female	56.5	56.7	70.6	103.4	80.8	58.7	61.6
Total	60.0	59.8	70.3	107.5	84.7	61.8	64.5

Per 100,000

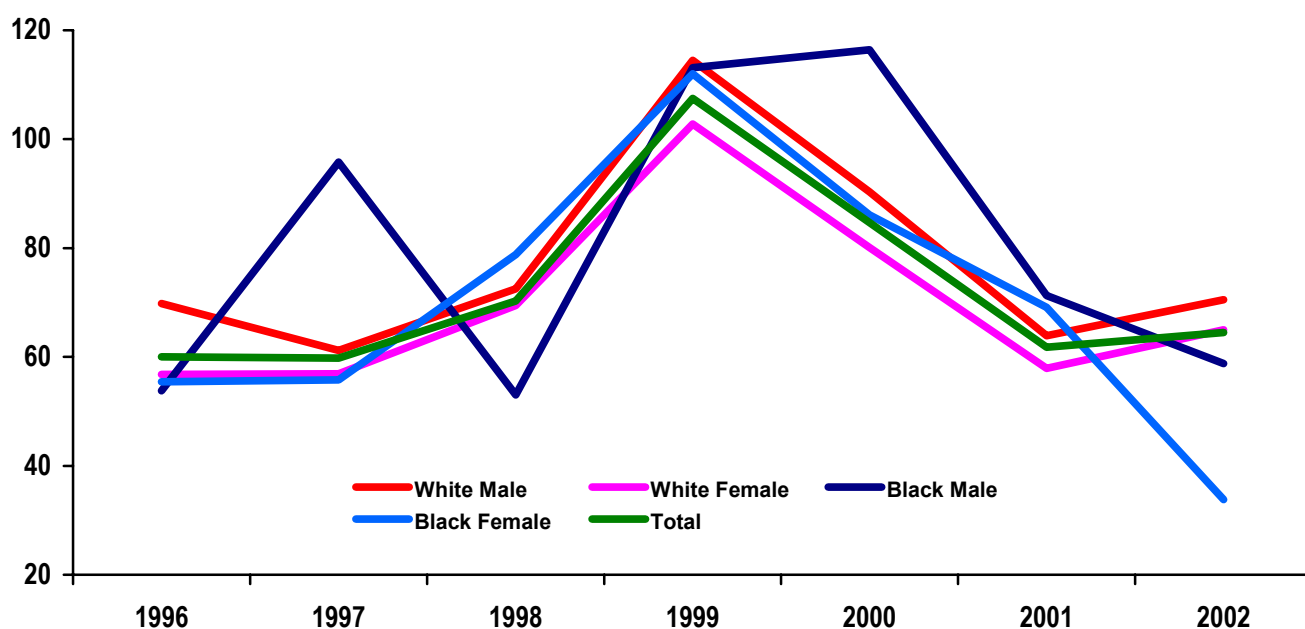


Figure 3.37. Trends in Age-adjusted Mortality Rate from Congestive Heart Failure, Age 65 and Over, 1996-2002, Tennessee, DSSS

Figure 3.38. is a map of the age-adjusted mortality rates from CHD by county for the total Tennessee population, based on DSSS data (five-year average, 1998-2002). **Figure 3.39.** is a map of the age-adjusted mortality rates from CHD by county for the age 65 and over population, based on DSSS data (five-year average, 1998-2002). The darker portions of the map reflect higher age-adjusted mortality rates from CHD.

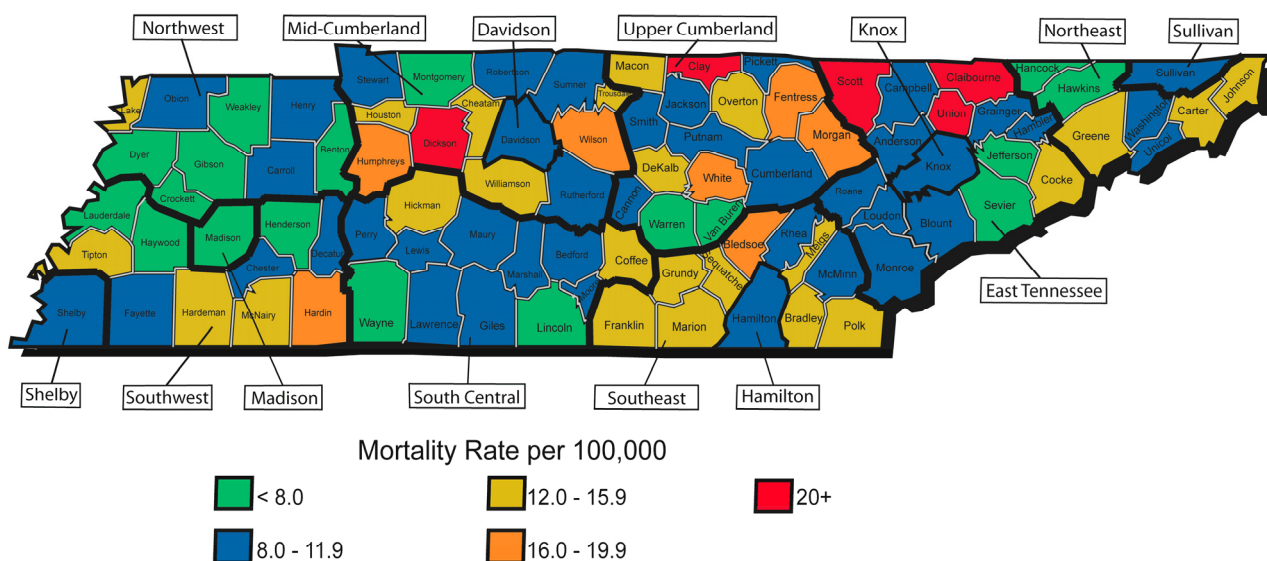


Figure 3.38. Average Age-adjusted Mortality Rate from Congestive Heart Failure by County and Health Service Region, Total Population, 1998-2002, Tennessee, DSSS

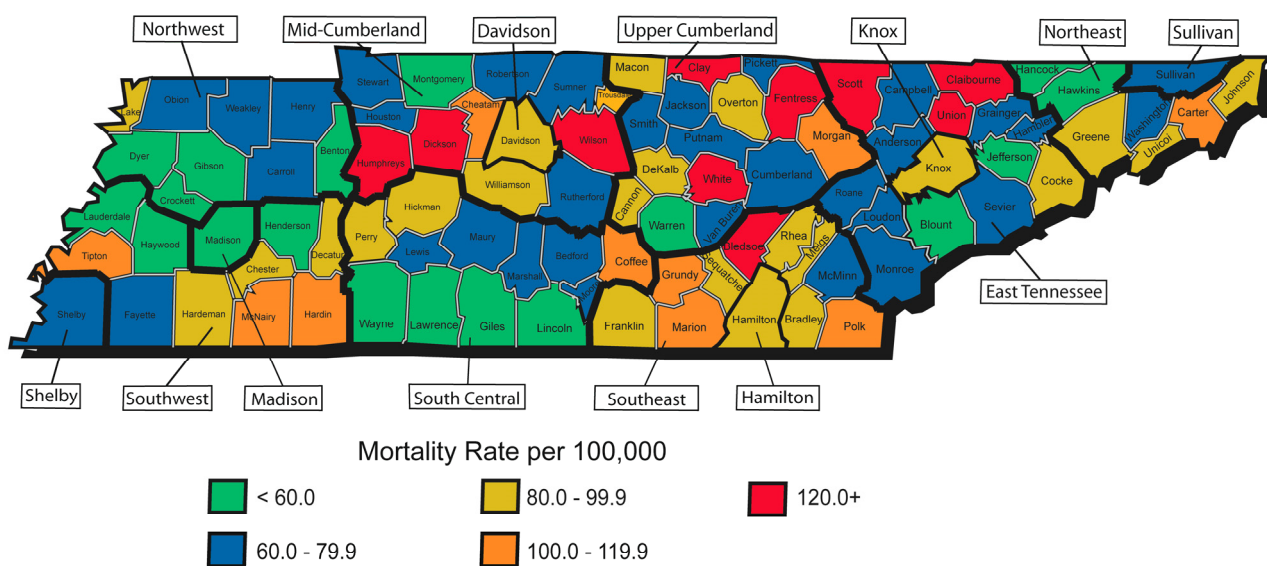


Figure 3.39. Average Age-adjusted Mortality Rate from Congestive Heart Failure by County and Health Service Region, Age 65 and Over, 1998-2002, Tennessee, DSSS

IV. STROKE

(ICD-9-CM: 430-438) (ICD-10: I60 – I69)

A. Stroke (Overall)

Table 4.1. and **Figure 4.1.** present the frequencies for an item in the BRFSS, in which respondents report whether they have ever been told by a doctor that they had a stroke. According to the BRFSS data, 3.6% of the adult population in Tennessee reported that they had a physician-diagnosed stroke. The prevalence of stroke was higher for males (4.5%) compared to females (2.8%), and higher for Blacks (5.6%) compared to Whites (3.3%). Thus, Black men had the highest self-reported prevalence of stroke (9.1%), followed by White men (3.9%), Black women (2.8%), and White females with the lowest prevalence (2.7%).

Table 4.1. Prevalence of Ever Having a Stroke in 2001, Tennessee, BRFSS

GROUP	TOTAL	MALE	FEMALE
Total	3.6%	4.5%	2.8%
White	3.3%	3.9%	2.7%
Black	5.6%	9.1%	2.8%

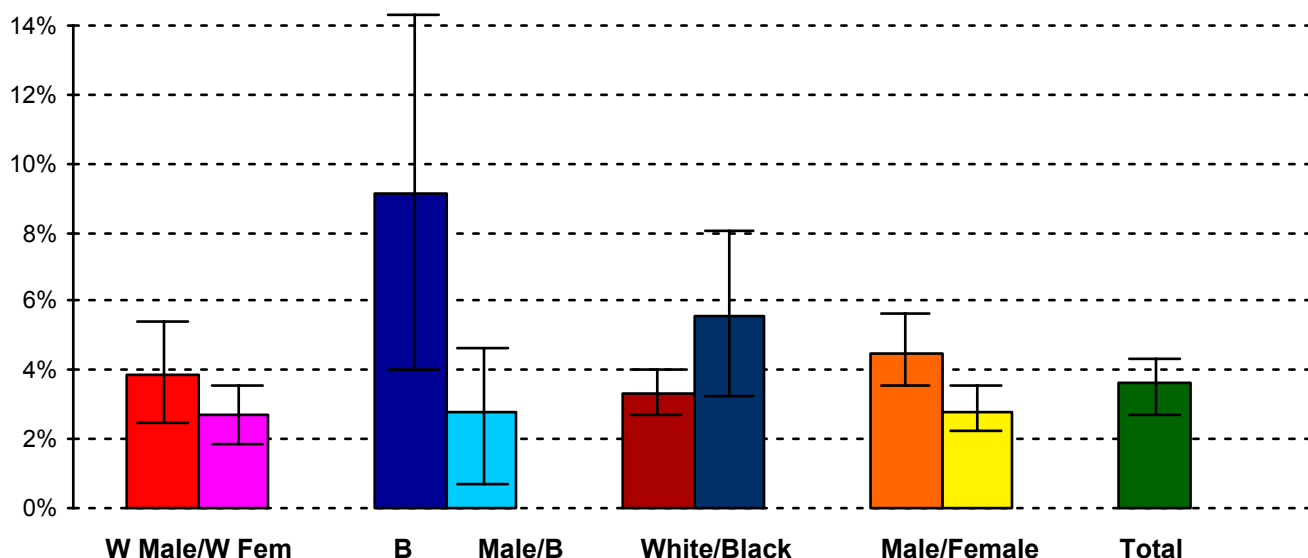


Figure 4.1. Prevalence of Ever Having a Stroke in 2001, Tennessee, BRFSS

Tables 4.2.-4.6. report the frequency and age-adjusted rates of stroke as a primary diagnosis from several data sources: inpatient files from HDDS (all ages) and CMS (age 65 and over), outpatient files from HDDS and CMS, and carrier (physician) files from CMS (See Technical Notes in Appendix A). The tables report data for the state of Tennessee for the total sample (including all races), by race, by gender, and by race-gender groups, covering the period of 1997-2002 for HDDS and 1996-2002 for CMS. The trends for HDDS inpatient data and CMS inpatient data are also illustrated in **Figures 4.2.** and **4.3.**

According to the HDDS data, the number of inpatients in Tennessee with a primary diagnosis of stroke increased by 6% from 18,943 in 1997 to 20,067 in 2002 (See **Table 4.2.**). However, the age-adjusted rates decreased by 2% from 352.5 to 346.7 per 100,000 population during this time period (See **Figure 4.2.**). This suggests that most of the raw increase in inpatients seen for stroke was due to an aging population.

The age-adjusted rates of stroke among inpatients were consistently higher for men compared to women, and higher for Blacks compared to Whites across the years. Black men and women had the highest age-adjusted rates of stroke, varying across the years in which gender was higher. In 2002 the age-adjusted rate of stroke for Black female inpatients was 477.5 per 100,000 population, and the rate for black males was 467.0 per 100,000 population. White men had slightly higher rates of stroke than white women as inpatients (319.7/100,000 and 302.7/100,000, respectively, in 2002)

Table 4.2. Frequency and Age-adjusted Rate of Stroke, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Frequencies						
White Male	6,543	6,555	6,661	6,723	6,849	6,774
White Female	8,354	8,459	8,681	8,648	8,684	9,025
Black Male	1,249	1,332	1,180	1,117	1,193	1,272
Black Female	1,817	2,055	1,757	1,694	1,684	1,960
Total White	14,903	15,023	15,348	15,374	15,533	15,799
Total Black	3,066	3,389	2,937	2,812	2,877	3,232
Total Female	10,710	11,138	11,052	11,148	11,277	11,548
Total Male	8,227	8,455	8,343	8,513	8,757	8,519
Total	18,943	19,605	19,401	19,665	20,034	20,067
Age-adjusted Rate Per 100,000						
White Male	339.4	335.0	331.8	330.5	330.0	319.7
White Female	296.9	295.7	299.5	296.5	295.0	302.7
Black Male	502.4	529.4	455.4	425.0	447.5	467.0
Black Female	478.2	530.8	449.0	430.4	423.3	477.5
Total White	315.3	312.5	314.5	311.8	310.3	310.8
Total Black	490.5	534.2	453.9	430.5	431.6	474.9
Total Female	334.8	342.9	336.0	336.2	336.1	340.0
Total Male	375.0	378.7	364.5	368.1	371.6	353.5
Total	352.5	358.6	349.6	350.7	351.7	346.7

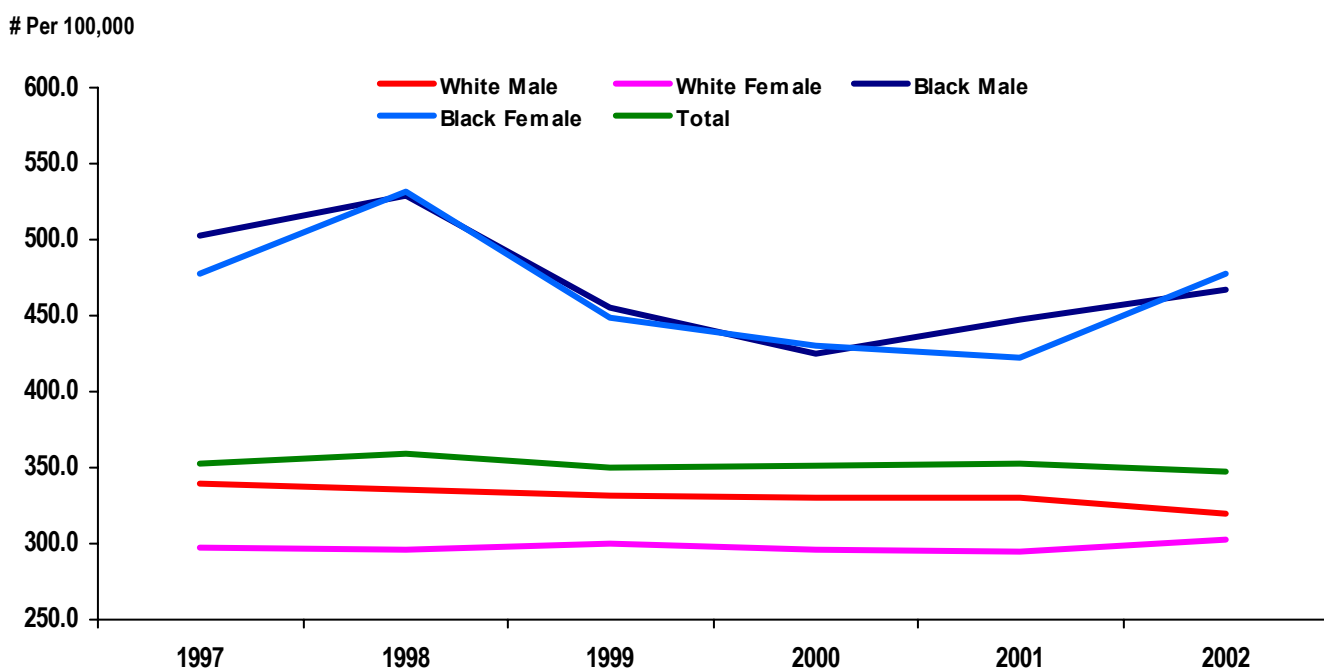


Figure 4.2. Trends in Age-adjusted Rate of Stroke, 1997-2002, Tennessee, HDDS Inpatient Files

According to CMS data, the number of inpatients age 65 and over in Tennessee with a primary diagnosis of stroke decreased by 10% from 15,534 in 1996 to 13,932 in 2002 (See **Table 4.3.**). The age-adjusted rates of stroke among inpatients were more than five times higher for the 65 and over population (CMS) compared to the general population (HDDS). Disregarding the data anomaly in 1997, the overall age-adjusted rates of stroke among elderly inpatients decreased by 15% from 2,232.1 per 100,000 to 1,888.1 per 100,000 population from 1996 to 2002 (See **Figure 4.3.**).

The age-adjusted rates of stroke among inpatients age 65 and over were slightly higher for men compared to women. For most years, the rate of stroke was higher for elderly Blacks compared to elderly Whites, given that the rate for Whites decreased by 17% compared to a 1% decrease among Blacks from 1996 to 2002. For most

years, age-adjusted rates of stroke among the 65 and over population were highest for Black females (2,411.8/100,000 in 2002), followed by Black males (2,316.9/100,000 in 2002), White males (1,844.0/100,000 in 2002), and White women with the lowest rate (1,817.9/100,000).

Table 4.3. Frequency and Age-adjusted Rate of Stroke, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	5,493	3,686	5,061	4,902	5,016	4,782	4,711
White Female	8,007	5,457	7,464	7,498	7,450	6,890	7,331
Black Male	639	372	578	600	590	560	637
Black Female	1,196	693	1,163	1,118	1,124	1,049	1,174
Total White	13,500	9,143	12,525	12,400	12,466	11,672	12,042
Total Black	1,835	1,065	1,741	1,718	1,714	1,609	1,811
Total Male	6,197	4,086	5,682	5,558	5,629	5,373	5,374
Total Female	9,337	6,207	8,738	8,742	8,645	7,995	8,558
Total	15,534	10,293	14,420	14,300	14,274	13,368	13,932
Age-adjusted Rate Per 100,000							
White Male	2,391.2	1,571.9	2,122.8	2,024.6	2,015.9	1,893.2	1,844.0
White Female	2,111.2	1,414.0	1,911.4	1,903.3	1,859.2	1,708.7	1,817.9
Black Male	2,320.5	1,344.6	2,112.2	2,160.3	2,145.2	2,064.7	2,316.9
Black Female	2,474.1	1,418.5	2,394.2	2,302.4	2,294.6	2,146.5	2,411.8
Total White	2,221.6	1,479.7	1,996.7	1,954.5	1,921.0	1,788.4	1,835.4
Total Black	2,424.9	1,393.1	2,297.7	2,268.4	2,244.2	2,118.9	2,391.0
Total Male	2,455.8	1,599.0	2,197.6	2,111.5	2,115.0	1,993.5	1,964.6
Total Female	2,253.7	1,477.3	2,055.8	2,044.1	2,010.3	1,838.8	1,952.0
Total	2,232.1	1,462.3	2,021.6	1,982.9	1,956.1	1,820.5	1,888.1

Per 100,000

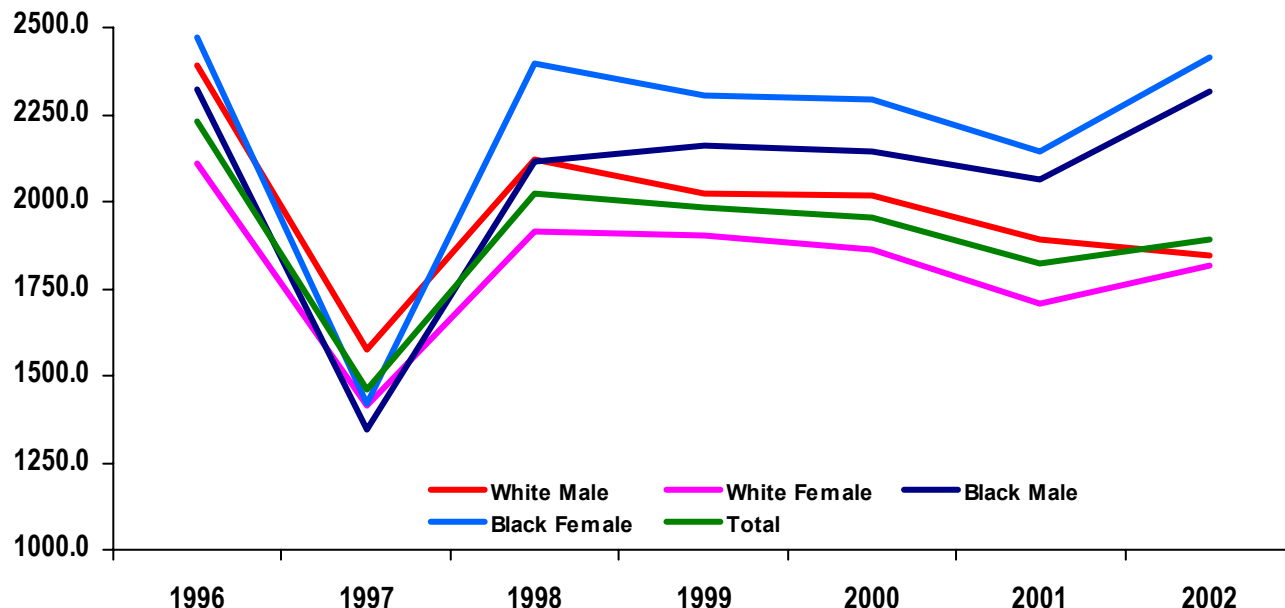


Figure 4.3. Trends in Age-adjusted Rate of Stroke, 1996-2002, Tennessee, CMS Inpatient Files

According to the HDDS data, the number of outpatients in Tennessee with a primary diagnosis of stroke increased by 91% from 4,669 in 1997 to 8,903 in 2002 (See **Table 4.4.**). However, the age-adjusted rates also increased by 77% from 60.4 to 106.7 per 100,000 population during this time period. This suggests that the raw increase in outpatients seen for stroke was not merely due to an aging population.

The age-adjusted rates of stroke among outpatients were slightly higher for men compared to women. In 1997 the outpatient stroke rate was higher for Blacks compared to Whites. However, the White rate increased by 93% compared to a 13% increase for Blacks, such that Whites had higher rates after 1999. These same patterns persist when comparing by race within each gender. White men had the highest age-adjusted rate of stroke as outpatients in 2002 (104.5/100,000), and White women had the second highest (101.9/100,000), followed by Black women (101.1/100,000) and Black men (92.1/100,000).

Table 4.4. Frequency and Age-adjusted Rate of Stroke, 1997-2002, Tennessee, HDDS Outpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Frequencies						
White Male	1,131	1,629	1,647	2,133	2,301	2,280
White Female	1,386	2,003	2,083	2,725	2,804	2,964
Black Male	218	274	217	239	255	271
Black Female	331	362	302	321	339	421
Total White	2,517	3,632	3,730	4,858	5,105	5,244
Total Black	549	636	519	560	594	692
Total Male	1,420	1,986	1,961	2,547	2,747	2,687
Total Female	1,829	2,458	2,507	3,255	3,387	3,529
Total	3,249	4,444	4,468	5,802	6,134	6,216
Age-adjusted Rate Per 100,000						
White Male	58.1	81.5	79.6	101.7	107.3	104.5
White Female	50.1	71.0	73.5	95.8	97.6	101.9
Black Male	84.5	109.1	82.8	86.2	92.3	92.1
Black Female	87.2	93.0	76.4	80.1	83.4	101.1
Total White	53.4	75.7	76.4	98.3	101.7	103.0
Total Black	86.8	99.5	79.8	83.0	86.6	97.7
Total Male	63.9	87.3	83.5	106.7	112.7	108.2
Total Female	57.8	76.1	77.2	99.7	102.3	105.5
Total	60.4	81.1	80.2	102.7	106.8	106.7

According to CMS data, the number of outpatients age 65 and over in Tennessee with a primary diagnosis of stroke increased by 8% from 21,759 in 1996 to 23,500 in 2002 (See **Table 4.5.**). (Note: The number of stroke cases in the CMS outpatient data is greater than in the HDDS outpatient data because not all facilities report to HDDS [e.g., VA facilities, non-hospital-affiliated outpatient clinics], while they all bill to CMS). Overall, the age-adjusted rates of stroke among elderly outpatients increased by 1% from 3,119.1 per 100,000 to 3,163.9 per 100,000 population from 1996 to 2002. This suggests that most of the raw increase in outpatients seen for stroke was due to an aging population.

The age-adjusted rates of stroke among outpatients age 65 and over were slightly higher for men compared to women in most years, and higher for Whites compared to Blacks. In 2002, among the elderly population, White males had the highest age-adjusted rate of stroke as outpatients (3,256.9/100,000), followed by White females (3,183.6/100,000), Black females (2,819.5/100,000), and Black males with the lowest rate (2,460.7/100,000).

Table 4.5. Frequency and Age-adjusted Rate of Stroke, 1996-2002, Tennessee, CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	7,681	8,705	8,802	8,332	8,416	8,448	8,527
White Female	11,804	12,618	13,528	12,896	13,006	12,978	12,810
Black Male	669	721	704	695	634	718	684
Black Female	1,335	1,309	1,340	1,309	1,375	1,443	1,357
Total White	19,485	21,323	22,330	21,228	21,422	21,426	21,337
Total Black	2,004	2,030	2,044	2,004	2,009	2,161	2,041
Total Female	8,451	9,502	9,568	9,098	9,088	9,205	9,264
Total Male	13,308	14,124	15,077	14,389	14,453	14,485	14,236
Total	21,759	23,626	24,645	23,487	23,541	23,690	23,500

Table 4.5. Continued

GROUP	1996	1997	1998	1999	2000	2001	2002
Age-adjusted Rate Per 100,000							
White Male	3,325.8	3,375.7	3,634.6	3,382.9	3,330.0	3,288.2	3,256.9
White Female	3,110.2	3,245.3	3,464.1	3,279.7	3,251.9	3,230.9	3,183.6
Black Male	2,447.1	2,518.1	2,558.7	2,550.1	2,282.5	2,576.5	2,460.7
Black Female	2,764.2	2,713.9	2,750.5	2,716.7	2,817.2	2,965.4	2,819.5
Total White	3,193.8	3,290.1	3,539.9	3,323.5	3,280.8	3,261.8	3,225.0
Total Black	2,656.4	2,629.4	2,686.9	2,659.8	2,633.9	2,841.9	2,705.2
Total Female	3,340.7	3,475.1	3,657.0	3,421.6	3,374.2	3,365.2	3,327.3
Total Male	3,216.7	3,403.1	3,555.4	3,382.0	3,377.4	3,356.0	3,269.4
Total	3,119.1	3,213.7	3,438.1	3,241.7	3,210.1	3,208.7	3,163.9

According to CMS carrier (physician) data, the number of patients age 65 and over in Tennessee who were seen by a physician with a primary diagnosis of stroke increased by 9% from 67,149 in 1996 to 73,305 in 2002 (See **Table 4.6.**). Overall, the age-adjusted rates of physician-diagnosed stroke among elderly patients increased by 3% from 9,603.4 per 100,000 to 9,872.0 per 100,000 population from 1996 to 2002. This suggests that some of the raw increase in patients seen for stroke was due to an aging population.

The age-adjusted rates of physician-diagnosed stroke among the age 65 and over population were slightly higher for men compared to women in most years except for 2002, in which the rate for women was slightly higher. The rates were also higher for Whites compared to Blacks. In 2002, among the elderly population, White males had the highest age-adjusted rate of physician-diagnosed stroke (9,950.7/100,000), followed by White females (9,971.8/100,000), Black females (9,554.6/100,000), and Black males with the lowest rate (8,607.7/100,000).

Table 4.6. Frequency and Age-adjusted Rate of Stroke, 1996-2002, Tennessee, CMS Carrier File

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	23,299	24,570	23,563	23,622	24,091	25,232	25,834
White Female	36,091	37,525	36,264	35,974	37,061	38,786	40,090
Black Male	2,462	2,501	2,335	2,167	2,174	2,329	2,357
Black Female	4,447	4,629	4,313	4,266	4,269	4,526	4,632
Total White	59,390	62,095	59,827	59,596	61,152	64,018	65,924
Total Black	6,909	7,130	6,648	6,433	6,443	6,855	6,989
Total Male	26,054	27,270	26,081	25,989	26,395	27,711	28,341
Total Female	41,095	42,571	41,075	40,779	41,617	43,569	44,964
Total	67,149	69,841	67,156	66,768	68,012	71,280	73,305
Age-adjusted Rate Per 100,000							
White Male	10,003.1	10,298.8	9,690.4	9,569.6	9,544.4	9,880.6	9,950.7
White Female	9,506.0	9,705.8	9,297.2	9,153.6	9,275.1	9,661.5	9,971.8
Black Male	8,993.0	9,082.8	8,517.7	7,922.1	7,912.4	8,455.4	8,607.7
Black Female	9,201.6	9,512.7	8,884.5	8,781.7	8,687.4	9,273.2	9,554.6
Total White	9,709.6	9,939.6	9,460.3	9,321.9	9,357.8	9,742.0	9,965.3
Total Black	9,129.4	9,363.1	8,762.8	8,507.2	8,422.9	9,020.6	9,240.9
Total Male	10,253.3	10,559.5	9,946.0	9,761.9	9,825.2	10,183.5	10,258.5
Total Female	9,936.6	10,164.8	9,708.0	9,587.4	9,735.4	10,105.0	10,336.5
Total	9,603.4	9,835.6	9,351.5	9,208.8	9,270.4	9,653.1	9,872.0

Figure 4.4. is a map of the age-adjusted rates of stroke by county, based on HDDS inpatient data (five-year average, 1998-2002). The darker portions of the map reflect higher age-adjusted rates of stroke. The ten counties with the lowest age-adjusted rates of stroke in Tennessee were Moore, Lincoln, Johnson, Sequatchie, Van Buren, Hardin, McMinn, Chester, Anderson, and Sevier (ranging from 186.5 to 279.1/100,000). The ten counties with the highest age-adjusted rates of stroke were Fentress, Houston, Morgan, Perry, Smith, Lauderdale, Claiborne, Decatur, Scott, and Greene (ranging from 438.9/100,000 in Greene to 599.9/100,000 in Fentress).

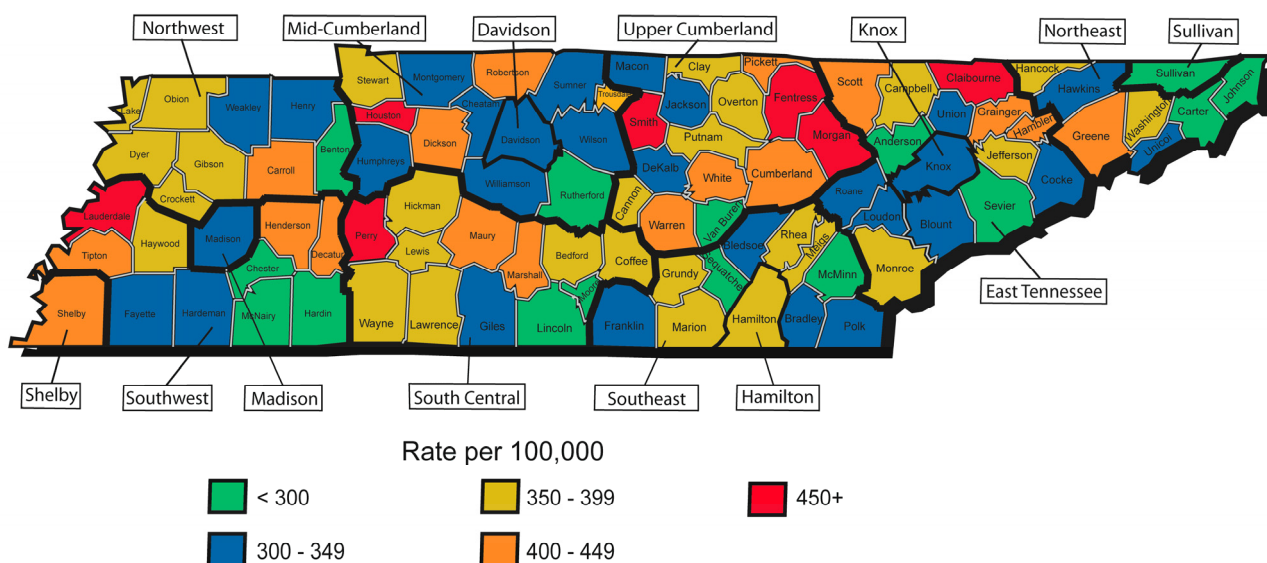


Figure 4.4. Average Age-adjusted Rate of Stroke by County and Health Service Region, 1998-2002, Tennessee, HDDS Inpatient Files

Figure 4.5. is a map of the age-adjusted rates of stroke by county for the age 65 and over population, based on CMS inpatient data (five-year average, 1998-2002). Again, the darker portions of the map reflect higher age-adjusted rates of stroke. The ten counties with the lowest age-adjusted rates of stroke among the elderly in Tennessee were Sullivan, Sevier, Chester, Sequatchie, Davidson, Hawkins, Knox, McMinn, Morgan, and Anderson (ranging from 1,496.6 to 1,672.6/100,000). Five of these were also among the lowest counties in the HDDS inpatient data. The ten counties with the highest age-adjusted rates of stroke among the elderly were Houston, Fentress, Crockett, Lake, Clay, Hancock, Claiborne, Pickett, Perry, and Smith (ranging from 2,866.2/100,000 in Smith to 3,943.0/100,000 in Houston). Five of these were also among the highest counties in the HDDS inpatient data.

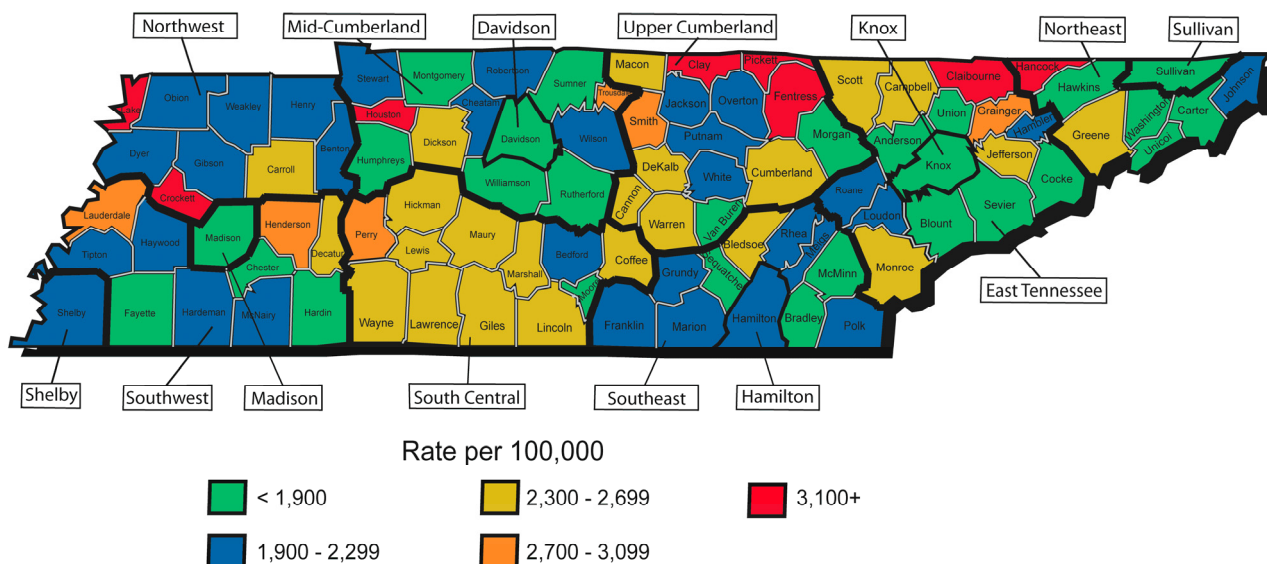


Figure 4.5. Average Age-adjusted Rate of Stroke by County and Health Service Region, 1998-2002, Tennessee, CMS Inpatient Files

Table 4.7. and **Figures 4.6.-4.10.** present the prevalence of major co-morbid conditions that may co-occur with stroke (i.e., hypertension (HTN), high cholesterol (HCL), and diabetes mellitus (DM)) based on the HDDS and CMS data sets. In the HDDS inpatient file, 18.5% of individuals with a primary diagnosis of stroke do not also have a diagnosis for HTN, HCL, or DM (See **Figure 4.6.**). More than three-fourths of inpatients with stroke also have a diagnosis of HTN, almost one-third also has a diagnosis of DM, and almost one-quarter also has a

diagnosis of high cholesterol. Almost one-third of inpatients with stroke have two of these co-morbid conditions, and 8% has all three of these co-morbid conditions.

Less co-morbid diagnoses show up in the HDDS outpatient file, since two in five individuals with stroke as a primary diagnosis do not have a co-morbid diagnosis of HTN, HCL, or DM (See **Figure 4.7.**). Half of outpatients with stroke also have a diagnosis of HTN, almost two-fifths also have a diagnosis of DM, and 9% also has a diagnosis of high cholesterol. Seventeen percent of outpatients with stroke have two of these co-morbid conditions, and 2% has all three of these co-morbid conditions.

The pattern of co-morbidity with stroke for the age 65 and over population in the CMS inpatient file is similar to that of the total population in the HDDS inpatient file (See **Figure 4.8.**). The main difference is that the level of stroke with HTN only is slightly higher in the CMS inpatient file. When comparing the pattern of co-morbidity for the age 65 and over population in the CMS outpatient file to that of the total population in the HDDS outpatient file (See **Figure 4.9.**), in the CMS inpatient file there are slightly lower levels of HTN only and HT/DM, as well as slightly higher levels of HCL only, HTN/HCL, and all three conditions.

The CMS carrier file represents the morbidity patterns of the general age 65 and over population, since the vast majority of Medicare beneficiaries are seen by a physician at least once a year. In the CMS carrier file, 15.6% of individuals with a primary diagnosis of stroke do not also have a diagnosis of HTN, HCL, or DM (See **Figure 4.10.**). Nearly three-fourths of patients with stroke also have a diagnosis of HTN, 28% also has a diagnosis of DM, and nearly half also has a diagnosis of high cholesterol. Over one-third of inpatients with stroke have two of these co-morbid conditions, and 13% has all three of these co-morbid conditions. The main difference between the CMS carrier file and the other files is that there are higher levels of diagnosed cholesterol and lower levels of diagnosed diabetes among patients with stroke compared to the inpatient and outpatient files.

Notably, as was the case with DOH, the pattern of co-morbidity with stroke differs by race in a fairly consistent pattern across inpatient, outpatient and carrier files for both the total population and the 65 and over population. In general Black patients with stroke are more likely than White patients to have co-morbid HTN only and HTN/DM, and they are less likely to have co-morbid HCL only and HTN/HCL.

Table 4.7. Co-morbidity of Stroke with Hypertension, Diabetes and Hypercholesterolemia, 2002, Tennessee

CO-MORBID CONDITION(S)	HDDS Inpatient	HDDS Outpatient	CMS Inpatient	CMS Outpatient	CMS Carrier
Total					
No Co-morbid Conditions	18.5%	43.2%	15.8%	38.2%	15.6%
Hypertension (HTN) Only	36.9%	31.4%	39.6%	25.9%	26.3%
Diabetes (DM) Only	3.8%	4.7%	3.8%	5.1%	3.1%
High Cholesterol (HCL) Only	2.6%	1.4%	2.2%	4.0%	6.4%
HTN & DM	17.0%	12.0%	17.7%	11.3%	10.5%
HTN & HCL	12.5%	4.9%	12.8%	9.1%	23.4%
DM & HCL	0.8%	0.4%	.5%	1.0%	1.9%
HTN & DM & HCL	7.9%	2.1%	7.5%	5.3%	12.8%
Total Whites					
No Co-morbid Conditions	19.3%	43.4%	16.8%	39.2%	16.0%
HTN Only	36.4%	31.3%	39.3%	25.6%	25.8%
DM Only	4.0%	4.7%	4.0%	4.9%	3.1%
HCL Only	2.9%	1.5%	2.5%	4.3%	6.9%
HTN & DM	15.5%	11.5%	16.0%	10.4%	9.2%
HTN & HCL	13.3%	5.2%	13.4%	9.3%	24.1%
DM & HCL	0.8%	0.4%	.6%	1.1%	2.0%
HTN & DM & HCL	7.8%	2.1%	7.4%	5.2%	12.8%

Table 4.6. Continued

CO-MORBID CONDITION(S)	HDDS Inpatient	HDDS Outpatient	CMS Inpatient	CMS Outpatient	CMS Carrier
Total Blacks					
No Co-morbid Conditions	13.1%	38.7%	8.9%	28.0%	10.8%
HTN Only	40.3%	34.0%	41.5%	28.9%	31.2%
DM Only	2.6%	4.3%	2.9%	6.9%	3.0%
HCL Only	0.9%	0.1%	.6%	1.2%	1.4%
HTN & DM	25.5%	17.2%	29.0%	21.0%	23.3%
HTN & HCL	8.7%	3.0%	8.8%	7.3%	15.9%
DM & HCL	0.3%	0.0%	.3%	.5%	.7%
HTN & DM & HCL	8.5%	2.6%	8.1%	6.3%	13.7%
No Co-morbid Conditions	100.0%	100.0%	8.9%	28.0%	10.8%

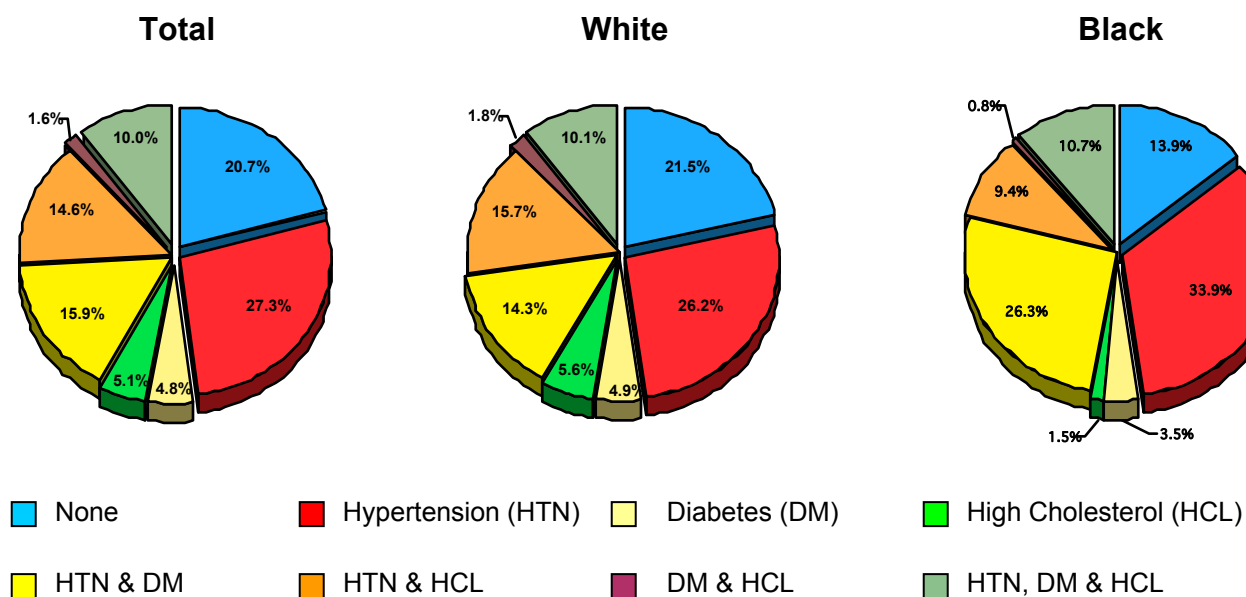


Figure 4.6. Co-morbidity of Stroke with Hypertension, Diabetes and Hypercholesterolemia, 2002, Tennessee, HDDS Inpatient Files

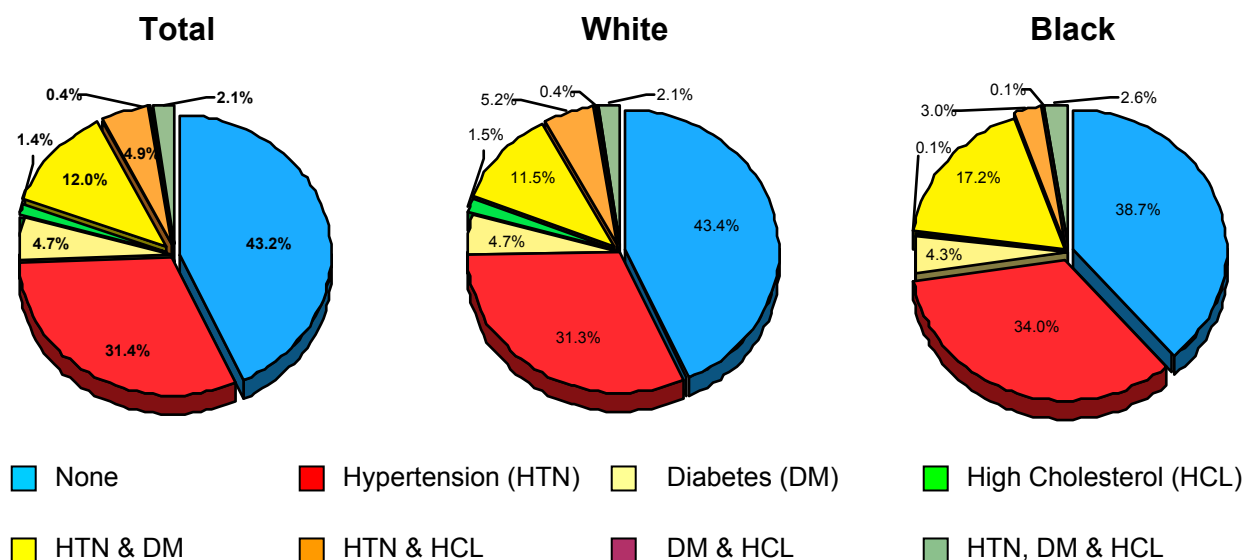


Figure 4.7. Co-morbidity of Stroke with Hypertension, Diabetes and Hypercholesterolemia, 2002, Tennessee, HDDS Outpatient Files

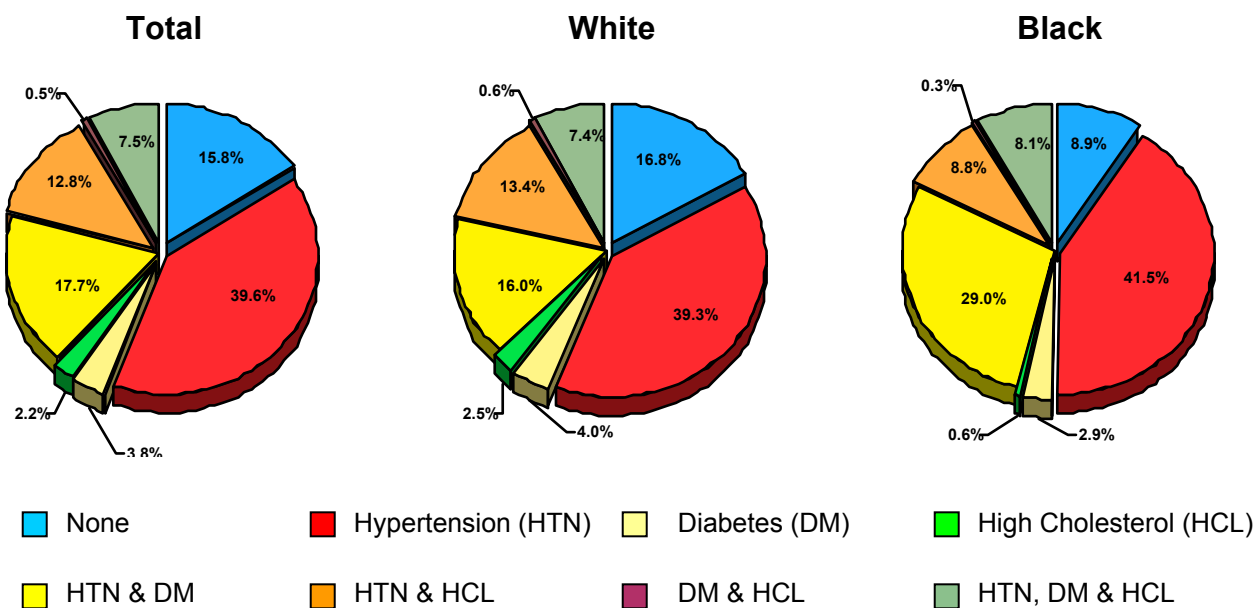


Figure 4.8. Co-morbidity of Stroke with Hypertension, Diabetes and Hypercholesterolemia, 2002, Tennessee, CMS Inpatient Files

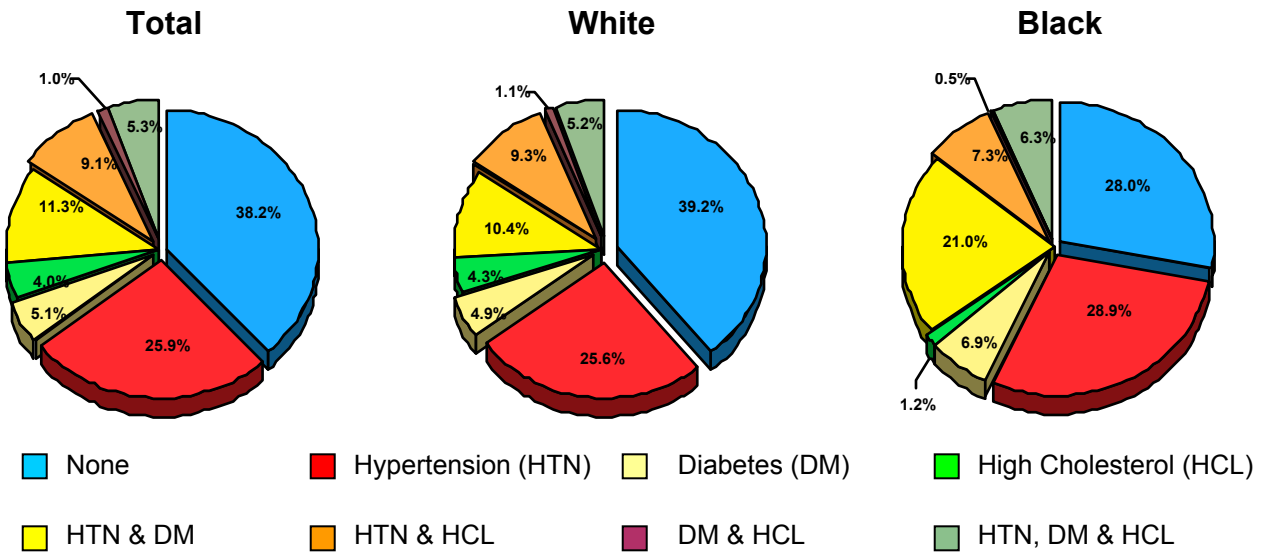


Figure 4.9. Co-morbidity of Stroke with Hypertension, Diabetes and Hypercholesterolemia, 2002, Tennessee, CMS Outpatient Files

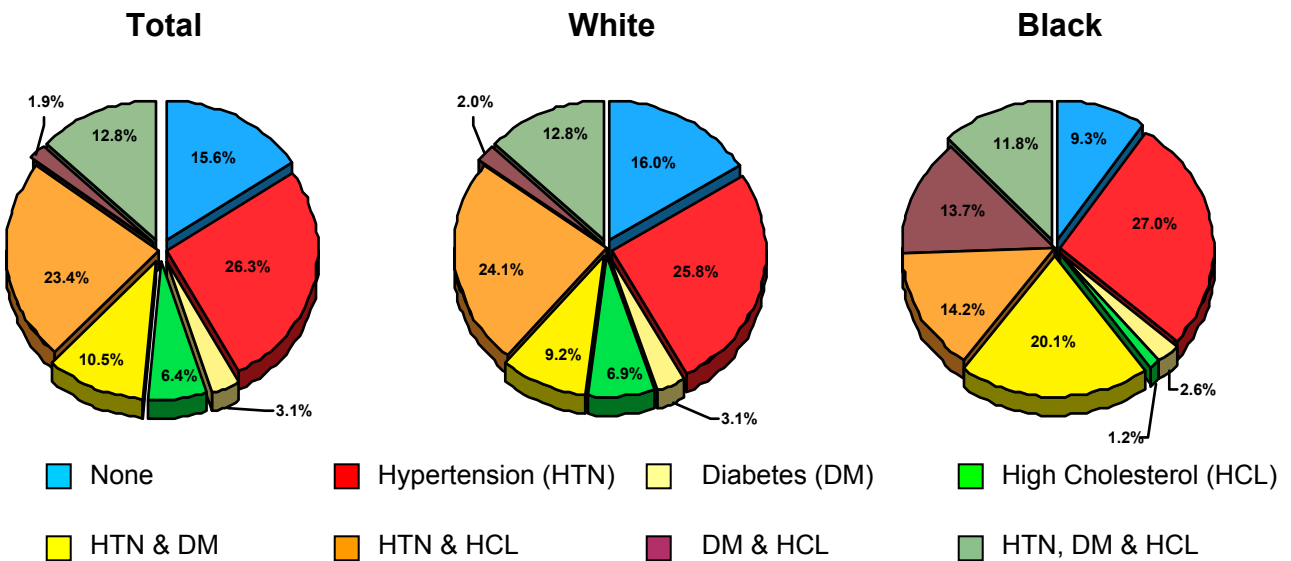


Figure 4.10. Co-morbidity of Stroke with Hypertension, Diabetes and Hypercholesterolemia, 2002, Tennessee, CMS Carrier Files

Table 4.8. reports the number of deaths and age-adjusted mortality rates from stroke based on the Death Statistical System Summary (DSSS) for Tennessee from 1996 to 2002. Approximately 4,000 people died from stroke in Tennessee annually, with a 2% decrease in the annual number of stroke deaths during this time period. The age-adjusted mortality rate from stroke decreased by 11% from 79.7 to 70.8 per 100,000 deaths during this time period (See **Figure 4.11.**).

Blacks had higher age-adjusted mortality rates from stroke compared to Whites (98.7/100,000 and 67.1/100,000, respectively, in 2002). Men had higher rates than women in 1996, but the stroke mortality rate for men decreased by 18% compared to 6% for women, such that women had higher stroke mortality by 2002 (71.0/100,000 and 69.1/100,000, respectively). Black men had the highest age-adjusted mortality from stroke (105.4/100,000 in 2002), followed by Black women (93.7/100,000 in 2002), White women (67.8/100,000 in 2002), and White men with the lowest (64.7/100,000 in 2002).

Table 4.8. Number of Deaths and Age-adjusted Mortality Rate from Stroke, Total Population, 1996-2002, Tennessee, DSSS

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	1,274	1,252	1,238	1,230	1,344	1,192	1,164
White Female	2,091	2,159	2,064	2,248	2,247	2,211	2,164
Black Male	295	294	281	228	268	270	251
Black Female	397	390	346	371	384	349	389
Total White	3,365	3,411	3,302	3,478	3,591	3,403	3,328
Total Black	692	684	627	599	652	619	640
Total Male	1,574	1,553	1,524	1,464	1,617	1,468	1,424
Total Female	2,490	2,556	2,421	2,624	2,640	2,570	2,558
Total	4,064	4,109	3,945	4,088	4,257	4,038	3,982
Age-adjusted Rate Per 100,000							
White Male	79.5	76.2	73.1	72.8	77.6	67.6	64.7
White Female	72.1	72.6	68.5	73.2	72.4	70.3	67.8
Black Male	128.7	127.2	122.8	95.0	117.0	116.5	105.4
Black Female	103.8	101.3	88.2	94.0	96.0	89.0	93.7
Total White	75.3	74.6	70.8	73.5	75.0	69.8	67.1
Total Black	114.1	111.6	101.5	95.1	104.6	99.0	98.7
Total Male	84.6	81.6	78.2	75.3	81.7	72.4	69.1
Total Female	75.9	76.2	71.1	75.7	75.3	72.3	71.0
Total	79.7	78.9	74.3	76.0	78.4	73.0	70.8

Per 100,000

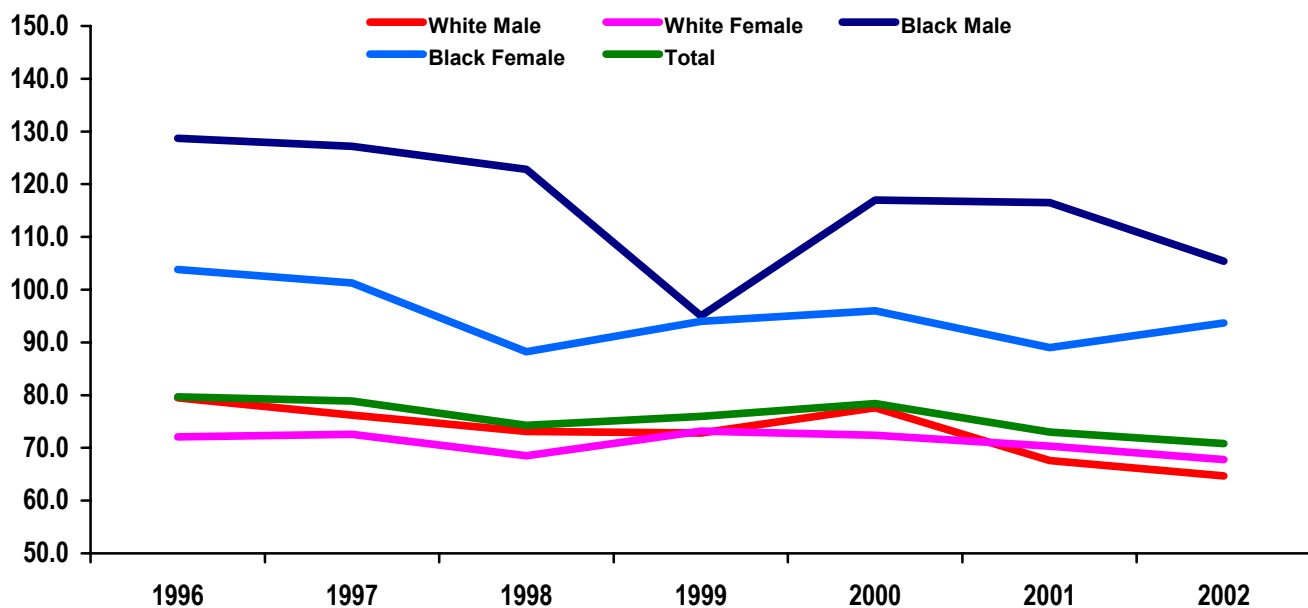


Figure 4.11. Trends in Age-adjusted Mortality Rate from Stroke, Total Population, 1996-2002, Tennessee, DSSS

Parallel mortality data for the age 65 and over population in Tennessee are presented in **Table 4.9.** and **Figure 4.12.** Approximately 3,500 people in this age group died from stroke in Tennessee annually, such that around 87% of the people who died from stroke each year were age 65 and over. Not surprisingly, the age-adjusted mortality rates from stroke for this age group were much higher than the rates for the general population. The age-adjusted mortality rates from stroke for the age 65 and over population in Tennessee decreased by 10% from 546.9.9 to 492.5 per 100,000 deaths during this time period.

As with the total Tennessee population, within the age 65 and over population age-adjusted mortality rates from stroke were consistently higher for Blacks compared to Whites (618.2/100,000 and 478.1/100,000, respectively, in

2002). As with the total population, elderly men had higher rates than elderly women in 1996, but the stroke mortality rate for elderly men decreased by 17% compared to 7% for elderly women, such that women had higher stroke mortality by 2002 (494.5/100,000 and 477.9/100,000, respectively, in 2002). The race-gender pattern of stroke mortality rates for the age 65 and over population mirrors the pattern for the total population, with the highest rates for Black men (662.3/100,000 in 2002), followed by Black women (584.5/100,000 in 2002), White women (484.1/100,000 in 2002), and White men with the lowest (458.0/100,000 in 2002).

Table 4.9. Number of Deaths and Age-adjusted Mortality Rate from Stroke, Age 65 and Over, 1996-2002, Tennessee, DSSS

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	1,061	1,057	1,049	1,053	1,150	997	984
White Female	1,922	1,990	1,887	2,078	2,090	2,014	1,986
Black Male	192	194	190	141	186	188	170
Black Female	316	303	273	292	314	291	299
Total White	2,983	3,047	2,936	3,131	3,240	3,011	2,970
Total Black	508	497	463	433	500	479	469
Total Male	1,257	1,256	1,242	1,199	1,338	1,187	1,160
Total Female	2,240	2,298	2,169	2,374	2,410	2,313	2,288
Total	3,497	3,554	3,411	3,573	3,748	3,500	3,448
Age-adjusted Rate Per 100,000							
White Male	554.4	536.4	515.8	519.3	553.1	474.8	458.0
White Female	513.8	519.7	485.8	526.5	524.9	498.1	484.1
Black Male	744.0	746.8	739.6	549.2	737.1	731.9	662.3
Black Female	652.0	623.0	553.7	593.0	627.8	599.1	584.5
Total White	530.6	530.2	500.8	527.1	539.2	493.0	478.1
Total Black	687.5	668.5	620.8	578.1	670.3	641.3	618.2
Total Male	572.1	557.5	537.6	521.2	569.9	497.6	477.9
Total Female	528.8	531.3	494.3	533.3	536.0	507.4	494.5
Total	546.9	544.8	513.8	531.6	552.4	507.9	492.5

Per 100,000

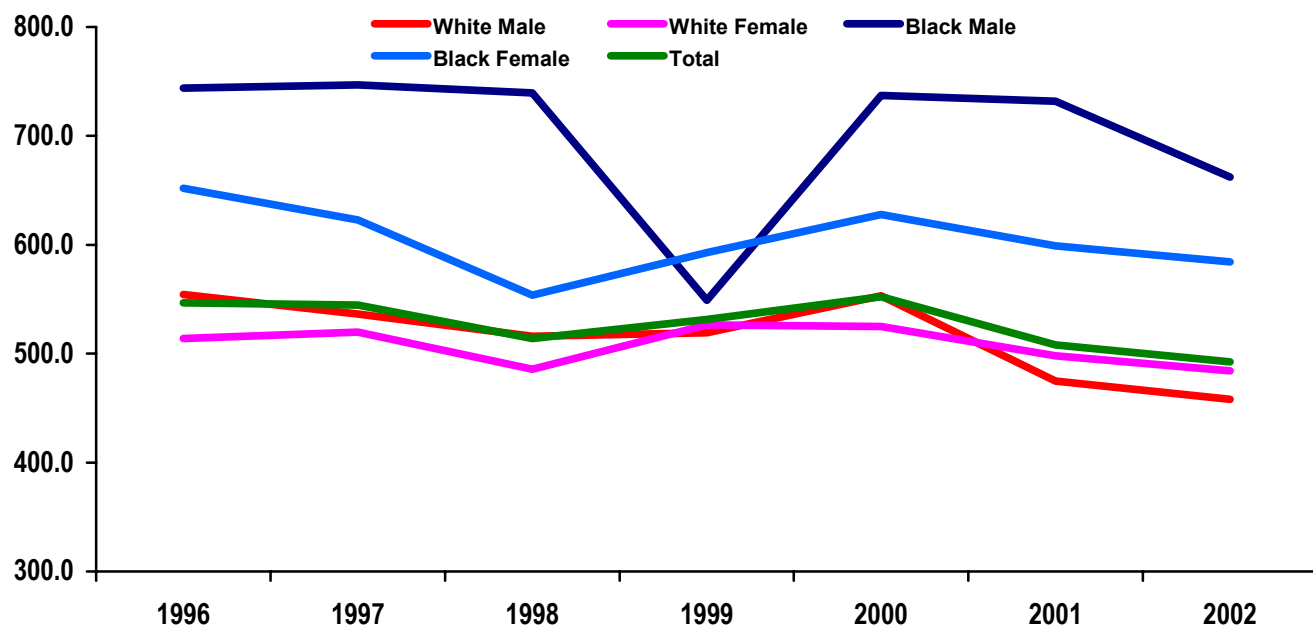


Figure 4.12. Trends in Age-adjusted Mortality Rate from Stroke, Age 65 and Over, 1996-2002, Tennessee, DSSS

Figure 4.13. is a map of the age-adjusted mortality rates from stroke by county for the total Tennessee population, based on DSSS data (five-year average, 1998-2002). The darker portions of the map reflect higher

age-adjusted mortality rates from stroke. The ten counties with the lowest age-adjusted mortality rates from stroke in Tennessee were Lewis, Pickett, Cheatham, Humphreys, Lauderdale, Claiborne, Polk, Benton, Macon, and Sequatchie (ranging from 37.3 to 56.3/100,000 deaths). The ten counties with the highest age-adjusted mortality rates from stroke were Henderson, Hardin, Hamblen, Smith, Cannon, White, Robertson, Grainger, Hancock, and Cocke (ranging from 96.0/100,000 deaths in Cocke to 184.7/100,000 in Henderson).

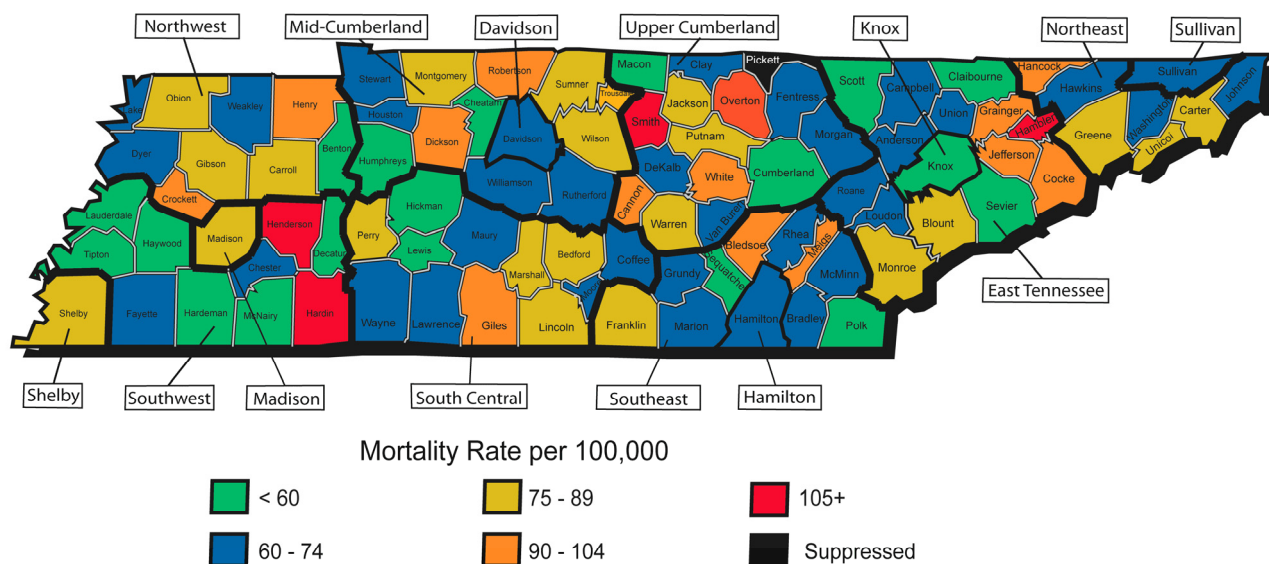


Figure 4.13. Average Age-adjusted Mortality Rate from Stroke by County and Health Service Region, Total Population, 1998-2002, Tennessee, DSSS

Figure 4.14. is a map of the age-adjusted mortality rates from stroke by county for the age 65 and over population, based on DSSS data (five-year average, 1998-2002). Again, the darker portions of the map reflect higher age-adjusted mortality rates from stroke. The ten counties with the lowest age-adjusted mortality rates from stroke among the elderly in Tennessee were Lewis, Pickett, Lauderdale, Humphreys, Van Buren, Cheatham, Benton, Hardeman, Haywood, and Tipton (ranging from 269.6 to 381.3/100,000). Six of these were also among the lowest counties for mortality from stroke in the total population. The ten counties with the highest age-adjusted rates of stroke among the elderly were Henderson, Hardin, Smith, Hamblen, Cannon, Grainger, White, Robertson, Hancock, and Cocke (ranging from 670.2/100,000 in Cocke to 1,317.4/100,000 in Henderson). These same ten counties were also the highest counties for mortality from stroke in the total population.

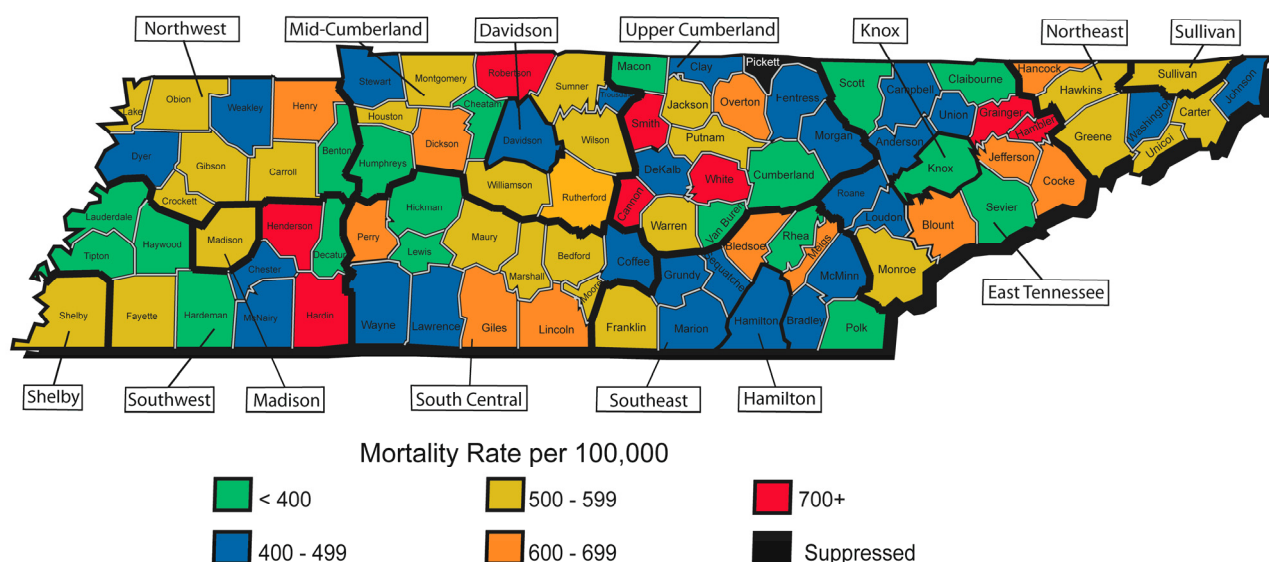


Figure 4.14. Average Age-adjusted Mortality Rate from Stroke by County and Health Service Region, Age 65 and Over, 1998-2002, Tennessee, DSSS

Table 4.10. presents calculations of years of potential life lost (YPLL) due to mortality from stroke based on the DSSS for Tennessee from 1996 to 2002. The total annual YPLL from stroke decreased by 8.6% from 15,811 in 1996 to 14,447 in 2002, with a total YPLL of 103,104 during this time period. Annual YPLL from stroke decreased by 21% for men, compared to a 7% increase for women. Annual YPLL from stroke decreased more rapidly for Whites (10% decrease) compared to Blacks (7% decrease).

Table 4.10. Years of Potential Life Lost from Stroke, 1996-2002, Tennessee, DSSS

GROUP	1996	1997	1998	1999	2000	2001	2002	Total
Frequencies								
White Male	6,020	5,341	5,370	4,791	5,033	5,098	4,646	36,299
White Female	4,721	4,965	4,965	4,925	4,560	5,258	4,992	34,386
Black Male	2,730	2,670	2,220	2,305	2,271	2,135	2,223	16,554
Black Female	2,295	2,320	2,128	2,248	1,929	1,691	2,448	15,059
Total White	10,741	10,306	10,335	9,716	9,593	10,356	9,638	70,685
Total Black	5,025	4,990	4,348	4,553	4,200	3,826	4,671	31,613
Total Male	8,795	8,079	7,644	7,130	7,358	7,334	6,939	53,279
Total Female	7,016	7,350	7,159	7,215	6,567	7,010	7,508	49,825
Total	15,811	15,429	14,803	14,345	13,925	14,344	14,447	103,104

B. Transient Ischemic Attacks (ICD-9-CM: 435) (ICD-10: I65)

Tables 4.11-4.15. report the frequency and age-adjusted rates of transient ischemic attacks (TIA) as a primary diagnosis from several data sources: inpatient files from HDDS (all ages) and CMS (age 65 and over), outpatient files from HDDS and CMS, and carrier (physician) files from CMS (See Technical Notes in Appendix A). The tables report data for the state of Tennessee for the total sample (including all races), by race, by gender, and by race-gender groups, covering the period of 1997-2002 for HDDS and 1996-2002 for CMS. The trends for HDDS inpatient data and CMS inpatient data are also illustrated in **Figures 4.15.** and **4.16.**

According to the HDDS data, the number of inpatients in Tennessee with a primary diagnosis of TIA increased by 8% from 3,881 in 1997 to 4,197 in 2002 (See **Table 4.11.**). However, the age-adjusted rates only increased less than 1% from 72.3 to 72.7 per 100,000 population during this time period (See **Figure 4.15.**). This suggests that most of the raw increase in inpatients seen for TIA was due to an aging population.

The age-adjusted rates of TIA among inpatients were consistently higher for women compared to men, and higher for Blacks compared to Whites across the years. Black women had the highest age-adjusted rates of TIA (97.8/100,000 in 2002), followed by black men (76.5/100,000 in 2002), then White women (71.7/100,000 in 2002), and white men with the lowest age-adjusted rate of TIA as inpatients (59.3/100,000 in 2002).

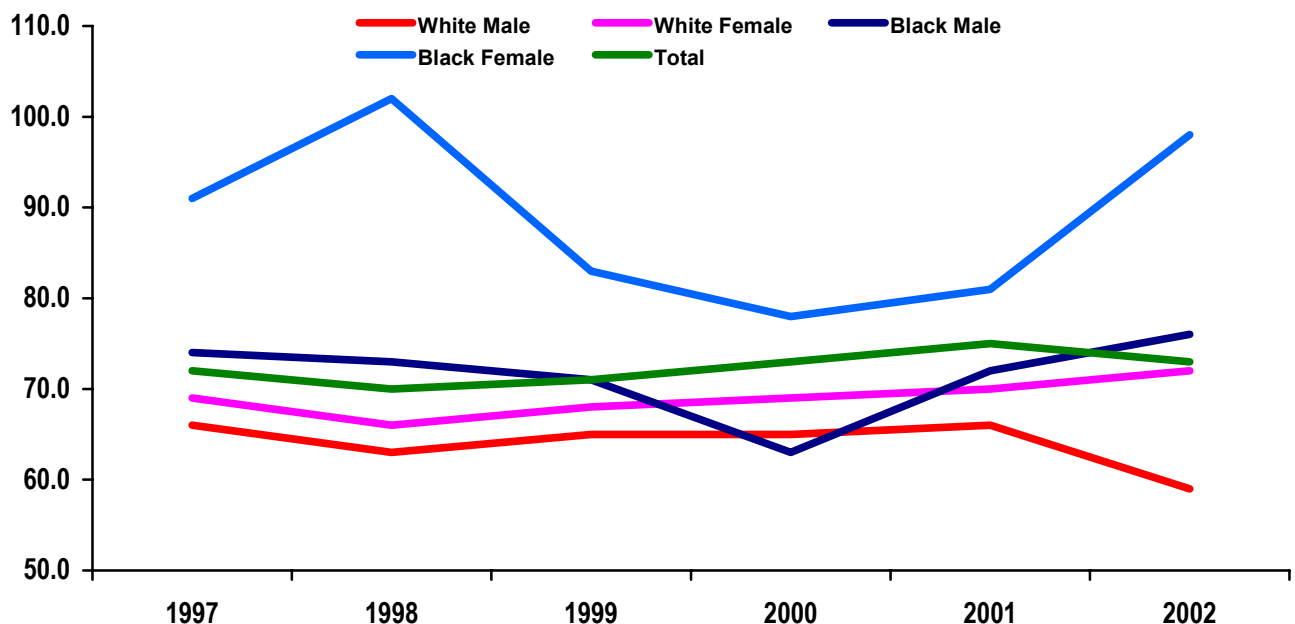
Table 4.11. Frequency and Age-adjusted Rate of Transient Ischemic Attacks, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Frequencies						
White Male	1,267	1,229	1,313	1,305	1,336	1,240
White Female	1,925	1,885	1,984	2,002	2,059	2,129
Black Male	179	180	180	161	191	200
Black Female	346	395	327	308	321	403
Total White	3,194	3,116	3,298	3,308	3,395	3,369
Total Black	525	575	507	469	512	603
Total Male	1,508	1,474	1,547	1,585	1,652	1,531
Total Female	2,371	2,371	2,390	2,487	2,595	2,666
Total	3,881	3,847	3,938	4,073	4,247	4,197

Table 4.11. Continued

GROUP	1997	1998	1999	2000	2001	2002
Age-adjusted Rate Per 100,000						
White Male	65.9	63.1	65.0	65.1	65.7	59.3
White Female	68.9	65.9	68.5	68.6	69.7	71.7
Black Male	73.6	73.4	70.9	63.0	71.5	76.5
Black Female	90.7	101.6	82.8	78.1	80.6	97.8
Total White	67.6	64.9	67.6	67.2	68.0	66.4
Total Black	83.7	90.8	77.9	72.3	76.7	89.2
Total Male	69.3	66.6	67.6	70.0	71.5	64.6
Total Female	74.6	73.0	72.7	74.8	77.1	78.7
Total	72.3	70.5	71.1	72.8	74.8	72.7

Per 100,000

**Figure 4.15. Trends in Age-adjusted Rate of Transient Ischemic Attacks, 1997-2002, Tennessee, HDDS Inpatient Files**

According to CMS data, the number of inpatients age 65 and over in Tennessee with a primary diagnosis of TIA decreased by 1% from 3,136 in 1996 to 3,103 in 2002 (See **Table 4.12.**). The age-adjusted rates of TIA among inpatients were five to six times higher for the 65 and over population (CMS) compared to the general population (HDDS). Disregarding the data anomaly in 1997, the overall age-adjusted rates of TIA among elderly inpatients decreased by 7% from 452.1 per 100,000 to 421.8 per 100,000 population from 1996 to 2002 (See **Figure 4.16.**).

The age-adjusted rates of TIA among inpatients age 65 and over were consistently higher for women compared to men, especially since the rate for men decreased by 13% compared to a 4% decrease for women. There was not a clear race pattern in TIA rates across years, but the rate for Whites decreased by 10% while the rate for Blacks increased by 17% from 1996 to 2002, such that the Black rate was higher in 2002. Given this racial difference in change in TIA rates, the race-gender pattern changes from 1996 to 2002. In 2002, age-adjusted rates of TIA among the 65 and over population were highest for Black females (518.6/100,000 in 2002), followed by White females (445.0/100,000 in 2002), Black males (435.7/100,000 in 2002), and White males with the lowest rate (366.2/100,000).

Table 4.12. Frequency and Age-adjusted Rate of Transient Ischemic Attacks, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	1,000	712	920	946	1,007	980	923
White Female	1,777	1,192	1,634	1,723	1,802	1,718	1,792
Black Male	97	58	82	98	92	86	118
Black Female	223	134	241	200	228	208	254
Total White	2,777	1,904	2,554	2,669	2,809	2,698	2,715
Total Black	1,512	1,574	1,521	1,440	1,462	1,594	1,446
Total Male	320	192	323	298	320	294	372
Total Female	1,106	776	1,014	1,055	1,107	1,070	1,044
Total	2,030	1,335	1,903	1,944	2,043	1,945	2,059
Age-adjusted Rate Per 100,000							
White Male	441.9	306.5	389.7	390.5	413.4	393.7	366.2
White Female	469.3	309.4	418.4	437.9	448.8	425.5	445.0
Black Male	363.2	211.8	312.2	359.6	342.5	334.4	435.7
Black Female	459.0	275.5	493.8	410.1	460.0	426.5	518.6
Total White	458.7	308.8	407.7	421.6	433.7	414.9	415.0
Total Black	421.3	251.8	427.8	392.4	418.4	388.2	491.5
Total Male	444.5	306.6	396.7	402.2	424.1	403.1	385.4
Total Female	490.6	318.2	447.6	454.5	474.1	446.8	470.2
Total	452.1	300.8	409.9	417.0	432.6	412.0	421.8

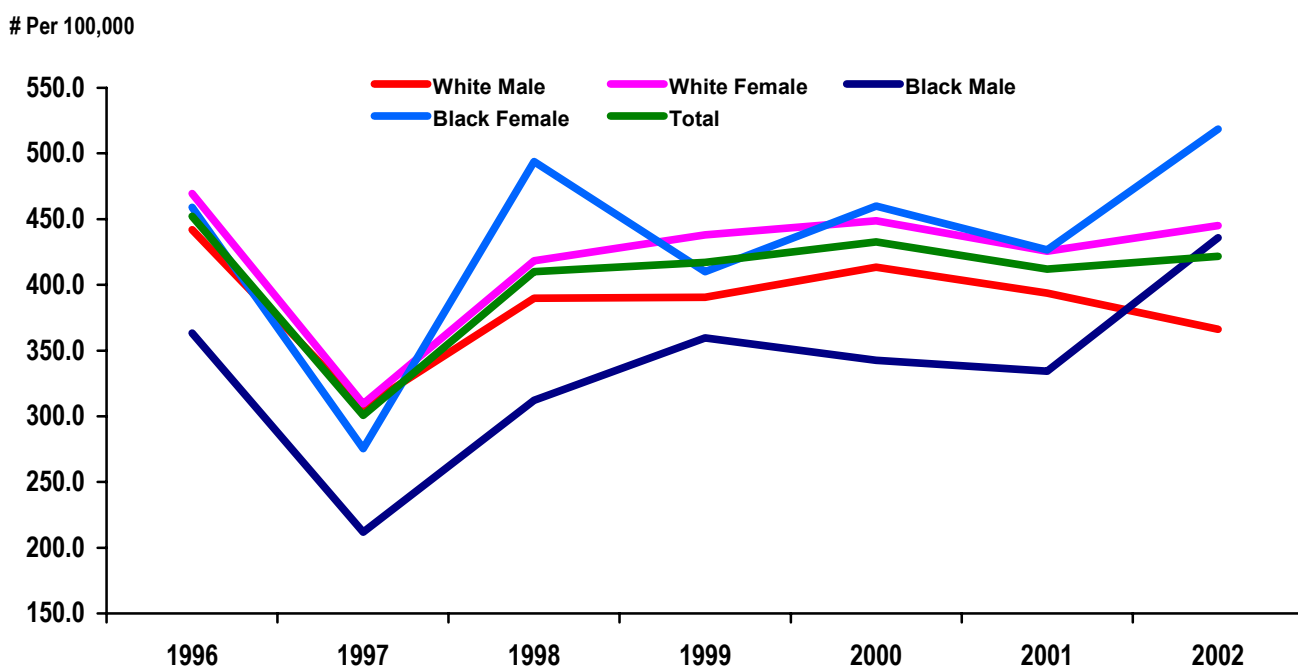


Figure 4.16. Trends in Age-adjusted Rate of Transient Ischemic Attacks, 1996-2002, Tennessee, CMS Inpatient File

According to the HDDS data, the number of outpatients in Tennessee with a primary diagnosis of TIA increased by 106% from 1,695 in 1997 to 3,490 in 2002 (See **Table 4.13.**). However, the age-adjusted rates also increased by 89% from 31.7 to 60.1 per 100,000 population during this time period. This suggests that the raw increase in outpatients seen for TIA was not merely due to an aging population.

The age-adjusted rates of TIA among outpatients were slightly higher for women compared to men. In 1997 the outpatient TIA rate was higher for Blacks compared to Whites. However, the White rate increased by 106% compared to a 16% increase for Blacks, such that Whites had higher rates after 1998. These same patterns

persist when comparing by race within each gender. White women had the highest age-adjusted rate of TIA as outpatients in 2002 (60.1/100,000), and White men had the second highest (56.6/100,000), followed by Black men (52.4/100,000) and Black women (43.0/100,000).

Table 4.13. Frequency and Age-adjusted Rate of Transient Ischemic Attacks, 1997-2002, Tennessee, HDDS Outpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Frequencies						
White Male	559	797	838	1,141	1,226	1,209
White Female	774	1,140	1,195	1,614	1,642	1,763
Black Male	88	113	106	108	119	119
Black Female	171	183	152	180	182	217
Total White	1,333	1,937	2,033	2,755	2,868	2,972
Total Black	259	296	258	288	301	336
Total Male	682	952	992	1,334	1,439	1,417
Total Female	1,013	1,377	1,414	1,915	1,967	2,073
Total	1,695	2,329	2,406	3,249	3,406	3,490
Age-adjusted Rate Per 100,000						
White Male	29.8	40.1	41.4	55.4	58.0	56.6
White Female	27.8	40.0	41.8	56.2	56.8	60.1
Black Male	35.5	46.5	41.5	41.0	44.7	43.0
Black Female	45.1	47.2	38.5	45.1	44.9	52.4
Total White	28.4	40.4	41.7	55.9	57.2	58.4
Total Black	41.6	47.0	40.4	43.6	44.7	48.3
Total Female	31.8	42.3	43.2	58.2	59.2	61.6
Total Male	31.8	42.3	43.3	57.1	60.1	58.6
Total	31.7	42.7	43.3	57.8	59.5	60.1

According to CMS data, the number of outpatients age 65 and over in Tennessee with a primary diagnosis of TIA increased by 24% from 4,996 in 1996 to 6,189 in 2002 (See **Table 4.14.**). (Note: The number of TIA cases in the CMS outpatient data is greater than in the HDDS outpatient data because not all facilities report to HDDS [e.g., VA facilities, non-hospital-affiliated outpatient clinics], while they all bill to CMS). Overall, the age-adjusted rates of TIA among elderly outpatients increased by 16% from 721.0 per 100,000 to 834.1 per 100,000 population from 1996 to 2002. This suggests that most of the raw increase in outpatients seen for TIA was due to an aging population.

The age-adjusted rates of TIA among outpatients age 65 and over were higher for women compared to men in most years, and higher for Whites compared to Blacks. In 2002, among the elderly population, White females had the highest age-adjusted rate of TIA as outpatients (898.7/100,000), followed by White males (834.4/100,000), Black females (579.9/100,000), and Black males with the lowest rate (409.7/100,000).

Table 4.14. Frequency and Age-adjusted Rate of Transient Ischemic Attacks, 1996-2002, Tennessee, CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	1,698	1,931	2,085	2,037	2,221	2,196	2,152
White Female	2,872	2,855	3,683	3,706	3,775	3,682	3,614
Black Male	118	176	104	112	109	122	111
Black Female	241	282	245	256	285	298	279
Total White	4,570	4,786	5,768	5,743	5,996	5,878	5,766
Total Black	359	458	349	368	394	420	390
Total Female	1,842	2,130	2,202	2,167	2,342	2,329	2,275
Total Male	3,154	3,180	3,978	4,004	4,080	4,004	3,914
Total	4,996	5,310	6,180	6,171	6,422	6,333	6,189

Table 4.14. Continued

GROUP	1996	1997	1998	1999	2000	2001	2002
Age Adjusted Rate Per 100,000							
White Male	753.8	744.1	867.6	830.7	883.3	861.9	834.4
White Female	756.9	733.6	944.3	943.1	943.9	917.6	898.7
Black Male	453.3	615.2	380.8	424.2	395.0	440.2	409.7
Black Female	496.3	579.7	501.0	527.7	585.7	609.3	579.9
Total White	754.2	738.2	915.1	901.2	918.4	894.9	872.2
Total Black	478.9	591.3	454.8	489.0	519.3	552.2	520.0
Total Female	744.5	775.7	847.4	819.4	874.8	856.7	827.5
Total Male	761.5	765.1	939.6	940.4	953.2	929.2	900.0
Total	721.0	721.8	863.0	854.1	876.4	858.1	834.1

According to CMS carrier (physician) data, the number of patients age 65 and over in Tennessee who were seen by a physician with a primary diagnosis of TIA remained stable at 19,533 in 1996 and 19,443 in 2002 (See **Table 4.15.**). Overall, the age-adjusted rates of physician-diagnosed TIA among elderly patients decreased by 6% from 2,793.7 per 100,000 to 2,621.5 per 100,000 population from 1996 to 2002.

The age-adjusted rates of physician-diagnosed TIA among the age 65 and over population were slightly higher for women compared men, and higher for Whites compared to Blacks. In 2002, among the elderly population, White females had the highest age-adjusted rate of physician-diagnosed TIA (2,813.7/100,000), followed by White males (2,561.3/100,000), Black females (2,038.3/100,000), and Black males with the lowest rate (1,695.6/100,000).

Table 4.15. Frequency and Age-adjusted Rate of Transient Ischemic Attacks, 1996-2002, Tennessee, CMS Carrier Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	6,660	7,038	6,666	6,621	6,849	6,988	6,593
White Female	11,123	11,643	11,219	11,418	11,626	11,877	11,313
Black Male	511	510	485	467	451	497	464
Black Female	1,001	1,064	1,036	973	1,011	1,097	982
Total White	17,783	18,681	17,885	18,039	18,475	18,865	17,906
Total Black	1,512	1,574	1,521	1,440	1,462	1,594	1,446
Total Female	7,257	7,600	7,184	7,142	7,343	7,519	7,084
Total Male	12,276	12,824	12,406	12,545	12,716	13,061	12,359
Total	19,533	20,424	19,590	19,687	20,059	20,580	19,443
Age-adjusted Rate Per 100,000							
White Male	2,882.3	2,969.5	2,757.8	2,694.0	2,735.0	2,750.5	2,561.3
White Female	2,930.5	3,010.7	2,878.6	2,908.6	2,911.3	2,959.2	2,813.7
Black Male	1,899.2	1,870.9	1,785.3	1,719.5	1,646.0	1,814.2	1,695.6
Black Female	2,079.7	2,190.0	2,138.5	1,998.7	2,061.9	2,251.4	2,038.3
Total White	2,906.8	2,986.8	2,831.2	2,823.6	2,829.3	2,873.0	2,710.7
Total Black	2,006.4	2,069.9	2,005.2	1,901.3	1,908.3	2,096.9	1,916.3
Total Female	2,871.6	2,958.2	2,753.2	2,693.5	2,751.0	2,773.6	2,579.7
Total Male	2,972.4	3,066.2	2,934.9	2,952.8	2,977.8	3,031.9	2,841.9
Total	2,793.7	2,874.1	2,731.1	2,717.9	2,736.0	2,788.7	2,621.5

Figure 4.17. is a map of the age-adjusted rates of TIA by county, based on HDDS inpatient data (five-year average, 1998-2002). The darker portions of the map reflect higher age-adjusted rates of TIA. The ten counties with the lowest age-adjusted rates of TIA in Tennessee were Chester, McMinn, Polk, Williamson, Van Buren, Sullivan, Union, Montgomery, Johnson, and Benton (ranging from 34.0 to 45.8/100,000). The ten counties with the highest age-adjusted rates of TIA were Fentress, Houston, Clay, Lauderdale, Claiborne, Hamblen, Scott, Cumberland, Hancock, and Pickett (ranging from 116.9/100,000 in Pickett to 216.6/100,000 in Fentress).

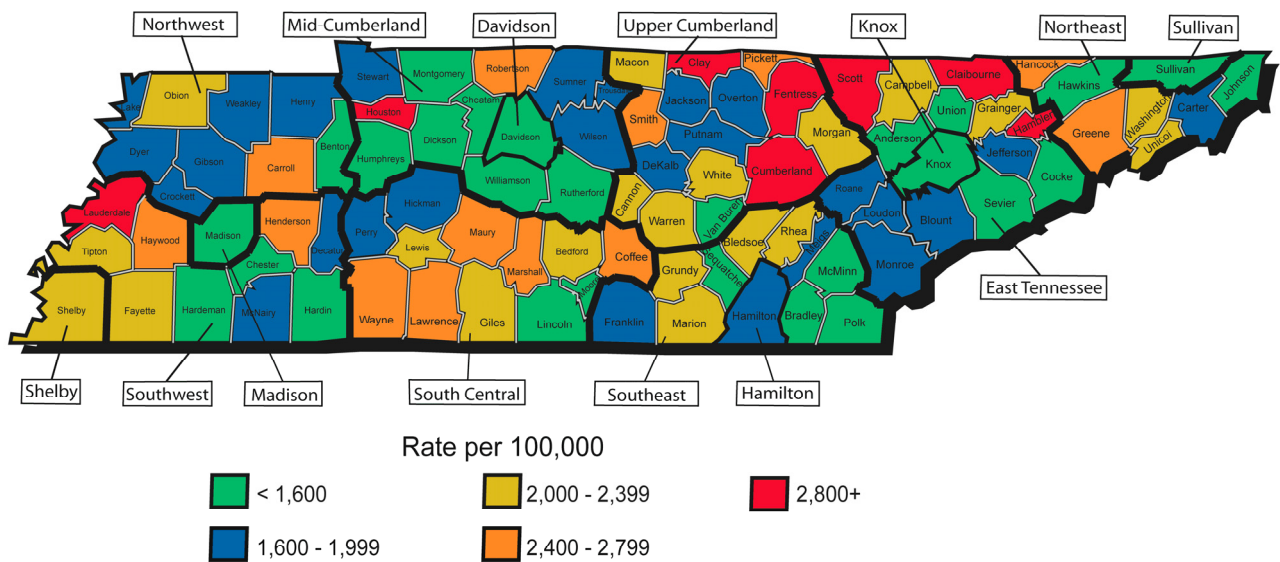


Figure 4.17. Average Age-adjusted Rate of Transient Ischemic Attacks by County and Health Service Region, 1998-2002, Tennessee, HDDS Inpatient Files

Figure 4.18. is a map of the age-adjusted rates of TIA by county for the age 65 and over population, based on CMS inpatient data (five-year average, 1998-2002). Again, the darker portions of the map reflect higher age-adjusted rates of TIA. The ten counties with the lowest age-adjusted rates of TIA among the elderly in Tennessee were Chester, Sevier, Montgomery, Sullivan, Williamson, Davidson, Bradley, Knox, Anderson, and McMinn (ranging from 200.8 to 313.8/100,000). Five of these were also among the lowest counties in the HDDS inpatient data. The ten counties with the highest age-adjusted rates of TIA among the elderly were Houston, Fentress, Clay, Hancock, Pickett, Claiborne, Macon, Lake, Lauderdale, and Henderson (ranging from 792.8/100,000 in Henderson to 1,327.8/100,000 in Houston). Seven of these were also among the highest counties in the HDDS inpatient data.

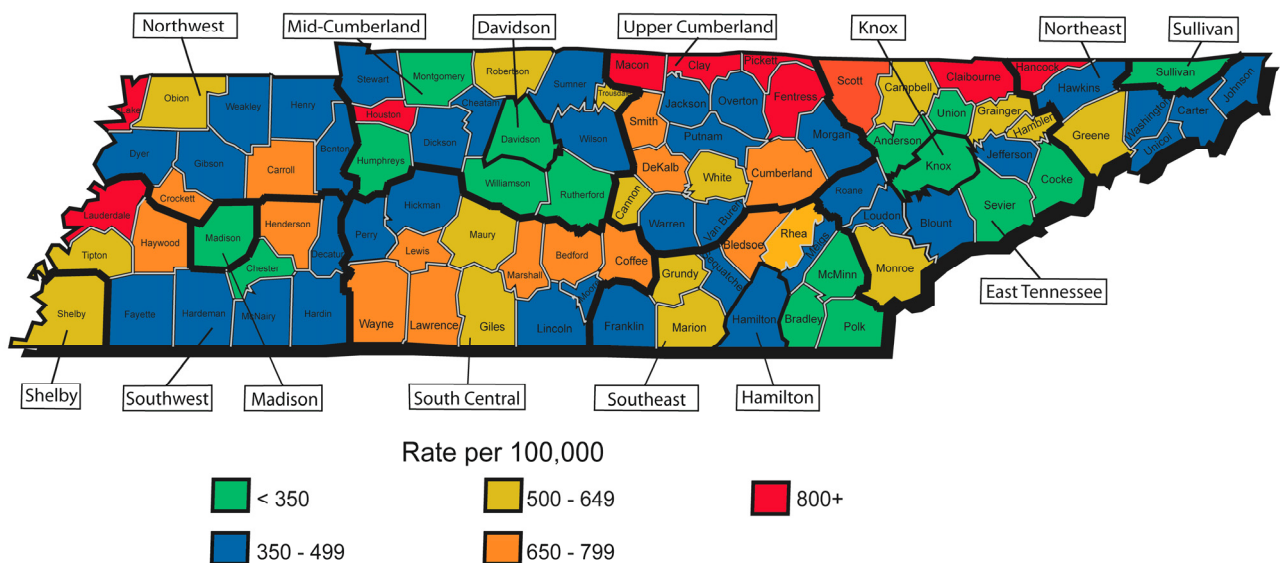


Figure 4.18. Average Age-adjusted Rate of Transient Ischemic Attacks by County and Health Service Region, 1998-2002, Tennessee, CMS Inpatient Files

V. Hypertension

(ICD-9-CM: 401 – 404) (ICD-10: I10 – I13)

Table 5.1. and **Figure 5.1.** present the frequencies for an item in the BRFSS, in which respondents report whether they have ever been told by a doctor that they had high blood pressure (or hypertension), from 1996 to 2002. The total prevalence of self-reported hypertension (HTN) stayed fairly constant during this time period between 27-30%.

The prevalence of HTN was slightly higher for women compared to men, and higher for Blacks compared to Whites during this time period. Black females consistently had the highest prevalence of HTN for all years (ranging between 34.7% and 38.5%) except for 2002, in which they were surpassed by Black males. The prevalence of HTN for Black males increased from 28.0% in 1996 to 38.3% in 2002. The prevalence for White males and White females fluctuated somewhat but stayed fairly stable around the prevalence for the total sample.

Table 5.1. Prevalence of Physician-diagnosed Hypertension, 1996-2002, Tennessee, BRFSS

GROUP	1996	1997	1998	1999	2000	2001	2002
White Male	29.5%	24.9%	24.3%	28.3%	25.6%	28.1%	29.2%
White Female	29.5%	29.5%	32.1%	28.9%	28.4%	29.0%	30.6%
Black Male	28.0%	25.6%	24.0%	24.9%	19.2%	31.9%	38.3%
Black Female	34.7%	37.4%	38.2%	36.2%	38.5%	36.4%	35.5%
Total White	29.5%	27.3%	28.4%	28.6%	27.1%	28.6%	29.8%
Total Black	31.7%	32.3%	32.1%	31.3%	30.1%	34.4%	36.6%
Total Male	28.8%	24.6%	24.2%	27.3%	24.3%	28.4%	29.6%
Total Female	29.8%	30.6%	32.7%	29.7%	29.5%	30.1%	31.1%
Total	29.3%	27.7%	28.6%	28.6%	27.1%	29.3%	30.3%

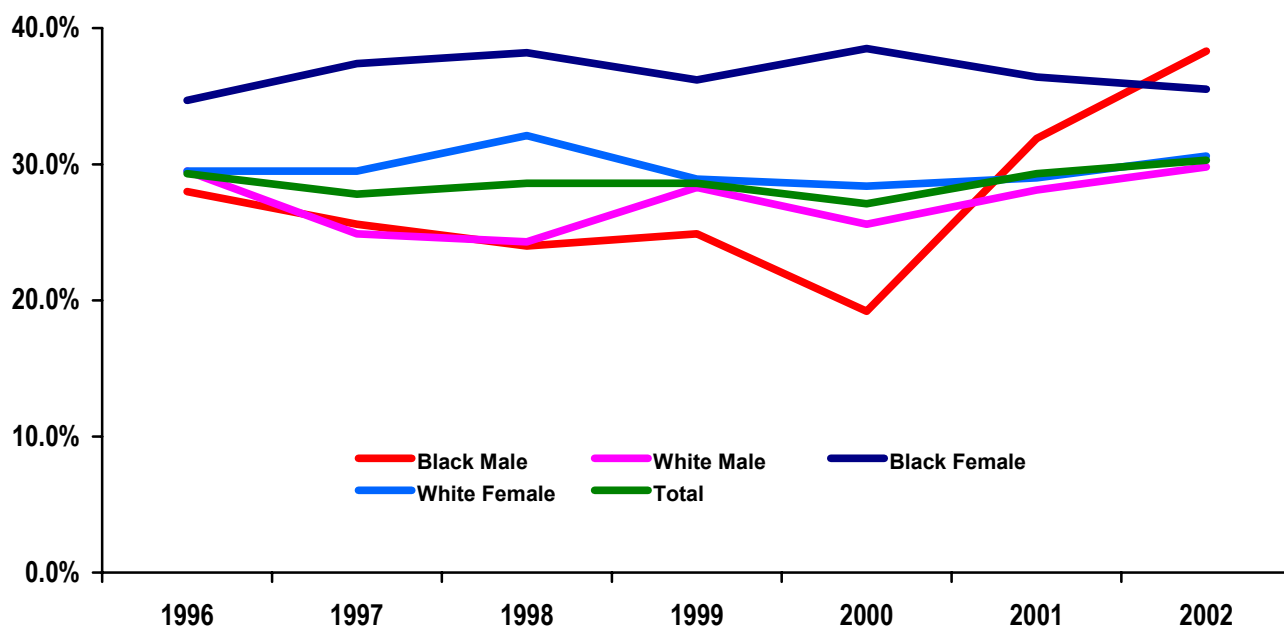


Figure 5.1. Trends in Prevalence of Physician-diagnosed Hypertension, 1996-2002, Tennessee, BRFSS

Tables 5.2.-5.6. report the frequency and age-adjusted rates of HTN as a primary diagnosis from several data sources: inpatient files from HDDS (all ages) and CMS (age 65 and over), outpatient files from HDDS and CMS, and carrier (physician) files from CMS (See Technical Notes in Appendix A). The tables report data for the state of Tennessee for the total sample (including all races), by race, by gender, and by race-gender groups, covering the period of 1997-2002 for HDDS and 1996-2002 for CMS. The trends for HDDS inpatient data and CMS inpatient data are also illustrated in **Figures 5.2.** and **5.3.**

According to the HDDS data, the number of inpatients in Tennessee with a primary diagnosis of HTN increased by 5% from 6,009 in 1997 to 6,320 in 2002 (See **Table 5.2.**). However, the age-adjusted rates decreased by 3% from 111.0 to 108.5 per 100,000 population during this time period (See **Figure 5.2.**). This suggests that most of the raw increase in inpatients seen for HTN was due to an aging population.

The age-adjusted rates of HTN among inpatients were consistently higher for women compared to men, and substantially higher for Blacks compared to Whites across the years. Black women had the highest age-adjusted rate of HTN in most years, followed by Black men (320.9/100,000 and 300.5/100,000, respectively, in 2002). White women had higher age-adjusted rates of HTN than White men (81.2/100,000 and 62.9/100,000, respectively, in 2002).

Table 5.2. Frequency and Age-adjusted Rate of Hypertension, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Frequencies						
White Male	39,110	41,482	44,775	48,971	53,182	57,640
White Female	54,572	57,949	62,397	68,252	73,992	80,888
Black Male	9,350	10,595	9,584	9,709	10,509	11,953
Black Female	14,870	16,743	15,795	15,393	16,667	19,400
Total White	93,701	99,470	107,209	117,242	127,174	138,528
Total Black	24,223	27,354	25,393	25,107	27,176	31,353
Total Male	50,432	55,622	57,684	63,197	68,952	73,308
Total Female	72,241	79,081	82,339	89,591	98,214	105,231
Total	122,696	134,763	140,076	152,813	167,166	178,539
Age-adjusted Rate Per 100,000						
White Male	70.2	66.6	60.6	70.1	70.5	62.9
White Female	82.5	76.8	74.5	82.9	86.4	81.2
Black Male	297.4	286.5	274.9	281.6	292.9	300.5
Black Female	318.2	290.5	291.1	281.3	324.4	320.9
Total White	78.0	73.1	69.2	77.7	80.1	73.8
Total Black	310.6	292.5	286.9	285.0	313.7	314.6
Total Male	100.7	100.0	90.1	100.3	103.4	95.5
Total Female	117.8	111.3	107.3	115.0	125.0	117.0
Total	111.0	107.5	100.8	109.5	116.4	108.5

Per 100,000

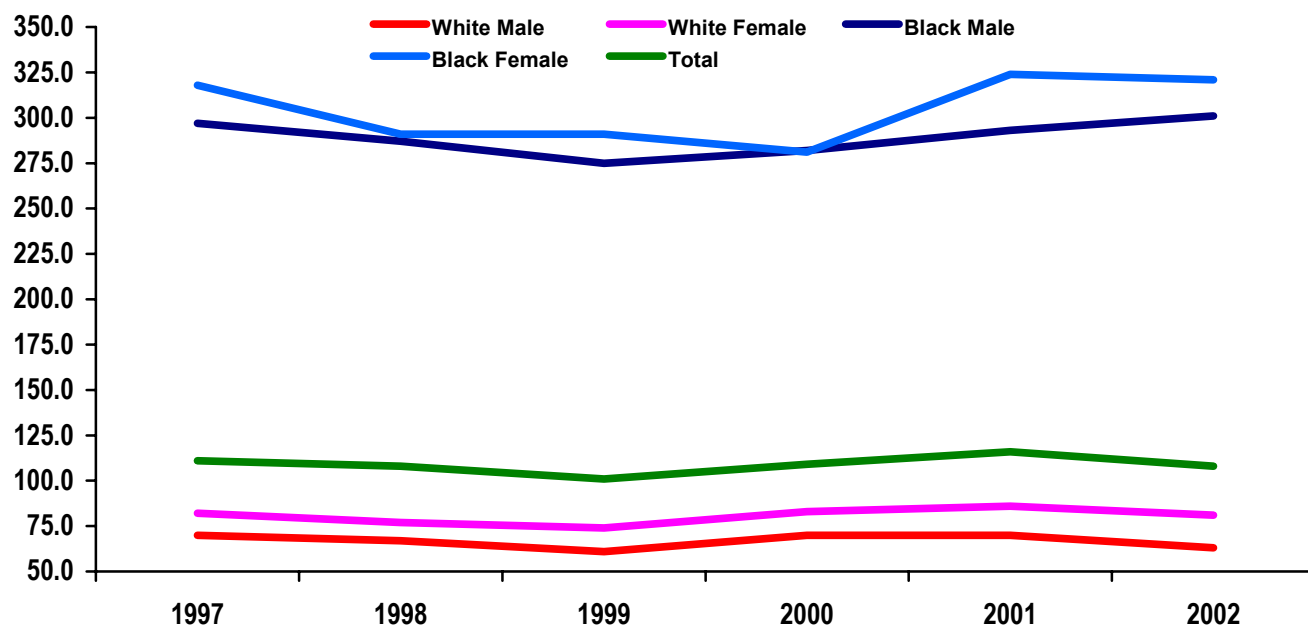


Figure 5.2. Trends in Age-adjusted Rate of Hypertension, 1997-2002, Tennessee, HDDS Inpatient Files

According to CMS data, the number of inpatients age 65 and over in Tennessee with a primary diagnosis of HTN decreased by 4% from 3,534 in 1996 to 3,387 in 2002 (See **Table 5.3.**). The age-adjusted rates of HTN among inpatients were more than four times higher for the 65 and over population (CMS) compared to the general population (HDDS). Overall, disregarding the data anomaly in 1997, the age-adjusted rates of HTN among elderly inpatients decreased by 10% from 502.9 per 100,000 to 455.0 per 100,000 population from 1996 to 2002 (See **Figure 5.3.**).

Table 5.3. Frequency and Age-adjusted Rate of Hypertension, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	861	643	853	734	861	872	751
White Female	1,750	1,296	1,713	1,660	1,777	1,833	1,744
Black Male	280	150	232	238	265	238	269
Black Female	596	358	517	552	561	644	604
Total White	2,611	1,939	2,566	2,394	2,638	2,705	2,495
Total Black	876	508	749	790	826	882	873
Total Male	1,158	799	1,094	982	1,135	1,114	1,026
Total Female	2,376	1,684	2,264	2,240	2,360	2,492	2,361
Total	3,534	2,483	3,358	3,222	3,495	3,606	3,387
Age-adjusted Rate Per 100,000							
White Male	370.0	275.6	350.6	301.1	342.4	346.5	297.0
White Female	461.3	336.1	439.1	422.1	444.3	456.9	433.5
Black Male	972.3	543.7	825.3	842.2	921.9	836.5	951.5
Black Female	1,235.7	729.7	1,065.9	1,157.3	1,146.9	1,325.9	1,259.9
Total White	427.9	313.9	407.0	376.1	404.7	413.6	378.2
Total Black	1,140.8	657.9	978.1	1,042.1	1,068.8	1,143.8	1,148.3
Total Male	450.4	314.9	414.5	368.7	419.1	411.6	373.6
Total Female	575.4	401.6	535.4	528.2	552.7	579.5	544.5
Total	502.9	351.7	466.6	443.7	475.0	487.7	455.0

Per 100,000

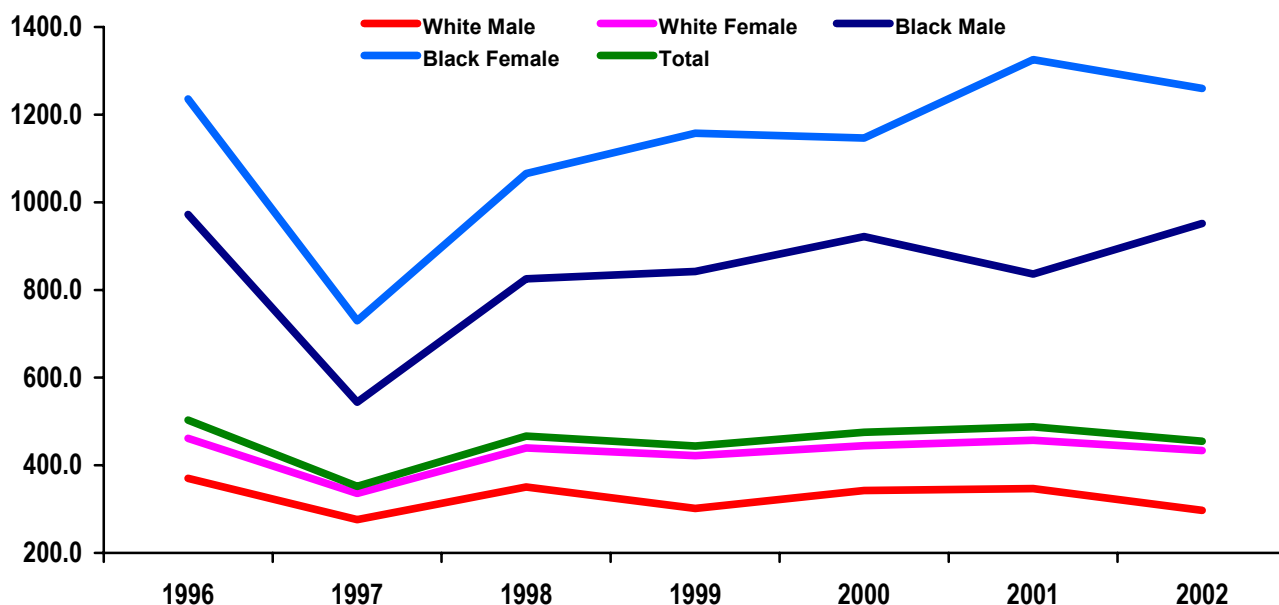


Figure 5.3. Trends in Age-adjusted Rate of Hypertension, 1996-2002, Tennessee, CMS Inpatient File

The age-adjusted rates of HTN among inpatients age 65 and over were consistently higher for women compared to men. For all years, the rate of HTN was two to three times higher for Blacks compared to Whites, especially since the rate for Whites decreased by 17% from 1996 to 2002. Black females had by far the highest age-adjusted rate of HTN, followed by Black males (1,259.9/100,000 and 951.5/100,000, respectively, in 2002). White

men had higher age-adjusted rates of HTN than White women (433.5/100,000 and 297.0/100,000, respectively, in 2002).

According to the HDDS data, the number of outpatients in Tennessee with a primary diagnosis of HTN increased by 75% from 7,830 in 1997 to 13,699 in 2002 (See **Table 5.4.**). However, the age-adjusted rates also increased by 63% from 142.6 to 232.6 per 100,000 population during this time period. This suggests that the raw increase in outpatients seen for HTN was not merely due to an aging population.

The age-adjusted rates of HTN among outpatients were higher for women compared to men. For all years, the rate of HTN was considerably higher for Blacks compared to Whites, in spite of the fact that the rate for Whites increased by 87% from 1997 to 2002 compared to a 28% increase for Blacks. Black females had by far the highest age-adjusted rate of HTN as outpatients, followed by Black males (559.3/100,000 and 414.7/100,000, respectively, in 2002). White women had higher age-adjusted rates of HTN as outpatients than White men (198.2/100,000 and 156.9/100,000, respectively, in 2002).

Table 5.4. Frequency and Age-adjusted Rate of Hypertension, 1997-2002, Tennessee, HDDS Outpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Frequencies						
White Male	21,120	31,652	35,373	51,764	63,943	76,168
White Female	29,502	43,931	48,563	71,127	86,968	102,602
Black Male	6,573	9,505	8,516	10,275	11,633	13,747
Black Female	12,134	17,579	15,987	18,481	20,747	25,501
Total White	50,629	75,598	83,943	122,896	150,911	178,770
Total Black	18,708	27,087	24,509	28,757	32,380	39,248
Total Male	28,746	42,777	46,046	66,851	80,970	93,863
Total Female	43,122	63,626	67,409	95,945	114,598	132,745
Total	71,876	106,424	113,470	162,805	195,568	226,608
Age-adjusted Rate Per 100,000						
White Male	86.0	113.4	109.1	139.0	146.8	156.9
White Female	103.1	137.8	134.5	171.6	185.4	198.2
Black Male	317.6	397.6	363.3	392.8	418.5	414.7
Black Female	438.5	514.7	466.6	497.0	515.8	559.3
Total White	96.4	128.0	124.3	158.6	169.2	180.6
Total Black	388.1	466.0	424.2	454.0	475.6	498.2
Total Male	121.8	156.3	149.2	182.1	193.3	197.8
Total Female	158.3	199.6	191.4	233.8	247.6	259.8
Total	142.6	181.1	173.6	212.0	224.3	232.6

According to CMS data, the number of outpatients age 65 and over in Tennessee with a primary diagnosis of HTN increased by 57% from 41,664 in 1996 to 65,350 in 2002 (See **Table 5.5.**). (Note: The number of HTN cases in the CMS outpatient data is greater than in the HDDS outpatient data because not all facilities report to HDDS [e.g., VA facilities, non-hospital-affiliated outpatient clinics], while they all bill to CMS). Overall, the age-adjusted rates of HTN among elderly outpatients increased by 49% from 5,802.3 per 100,000 to 8,657.4 per 100,000 population from 1996 to 2002. This suggests that most of the raw increase in outpatients seen for HTN was due to an aging population.

The age-adjusted rates of HTN among outpatients age 65 and over were consistently higher for women compared to men, and higher for Blacks compared to Whites. In 2002, among the elderly population, Black females had the highest age-adjusted rate of HTN as outpatients (15,095.0/100,000), followed by Black males (9,952.4/100,000), White females (9,235.6/100,000), and White males with the lowest rate (6,499.8/100,000).

Table 5.5. Frequency and Age-adjusted Rate of Hypertension, 1996-2002, Tennessee, CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	10,389	17,971	13,769	14,336	14,972	16,475	17,901
White Female	23,599	26,788	31,196	31,403	32,857	35,033	36,990
Black Male	1,899	1,607	2,379	2,345	2,576	2,619	2,835
Black Female	5,170	2,945	6,572	6,447	7,082	6,794	7,241
Total White	33,988	44,759	44,965	45,739	47,829	51,508	54,891
Total Black	7,069	4,552	8,951	8,792	9,658	9,413	10,076
Total Male	12,450	19,757	16,313	16,842	17,649	19,211	20,865
Total Female	29,214	30,127	38,244	38,411	40,162	42,068	44,485
Total	41,664	49,884	54,557	55,253	57,811	61,279	65,350
Age-adjusted Rate Per 100,000							
White Male	4,158.4	6,931.4	5,335.5	5,462.6	5,589.4	6,071.4	6,499.8
White Female	6,184.1	6,891.3	8,001.4	8,009.1	8,243.9	8,758.5	9,235.6
Black Male	6,597.4	5,578.2	8,304.7	8,259.3	8,988.5	9,209.3	9,952.4
Black Female	10,769.8	6,062.6	13,691.1	13,470.0	14,641.3	14,115.2	15,095.0
Total White	5,415.5	6,903.4	6,975.2	7,022.5	7,199.6	7,710.6	8,165.5
Total Black	9,198.9	5,885.6	11,687.7	11,528.0	12,526.7	12,269.4	13,174.1
Total Male	4,641.8	7,194.0	5,946.8	6,050.9	6,284.3	6,751.6	7,224.1
Total Female	7,102.1	7,258.3	9,126.9	9,138.5	9,505.8	9,880.2	10,362.3
Total	5,802.3	6,784.7	7,451.2	7,478.8	7,745.7	8,163.2	8,657.4

Figure 5.4. is a map of the age-adjusted rates of HTN by county, based on HDDS inpatient data (five-year average, 1998-2002). The darker portions of the map reflect higher age-adjusted rates of HTN. The ten counties with the lowest age-adjusted rates of HTN in Tennessee were Sequatchie, Sullivan, Anderson, Hardin, Moore, Bradley, Johnson, Union, Polk, and Carter (ranging from 43.1 to 58.2/100,000). The ten counties with the highest age-adjusted rates of HTN were Haywood, Fentress, Lauderdale, Montgomery, Houston, Stewart, Hardeman, Perry, Shelby, and Robertson (ranging from 153.4/100,000 in Robertson to 296.3/100,000 in Haywood).

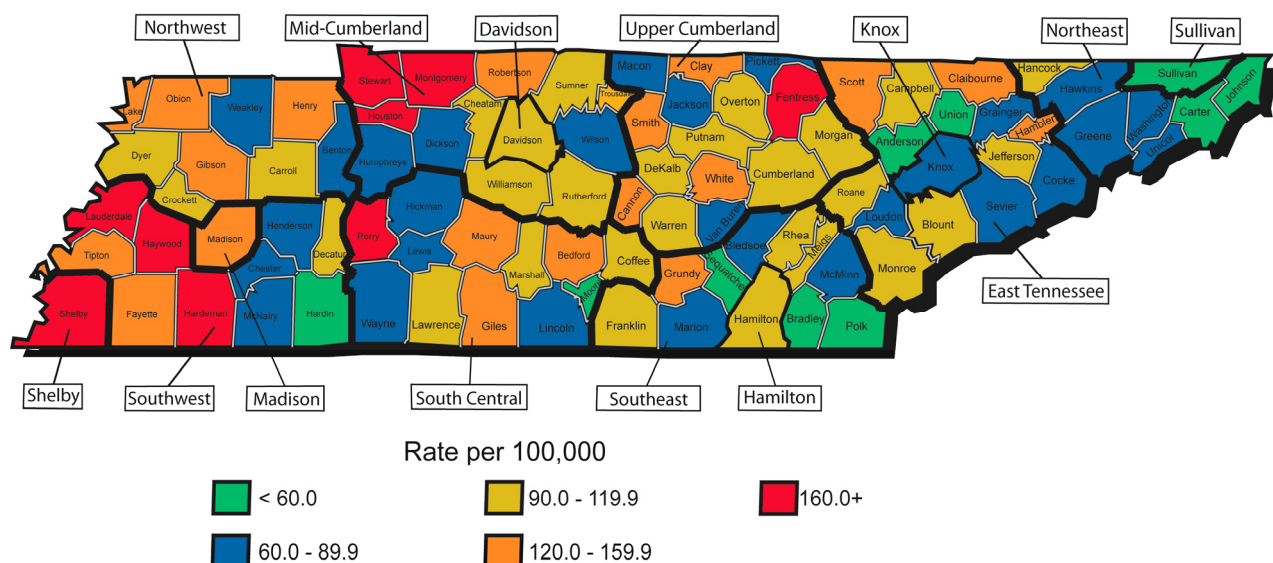


Figure 5.4. Average Age-adjusted Rate of Hypertension by County and Health Service Region, 1998-2002, Tennessee, HDDS Inpatient Files

Figure 5.5. is a map of the age-adjusted rates of HTN by county for the age 65 and over population, based on CMS inpatient data (five-year average, 1998-2002). Again, the darker portions of the map reflect higher age-adjusted rates of HTN. The ten counties with the lowest age-adjusted rates of HTN among the elderly in Tennessee were Sequatchie, Anderson, Sullivan, Bradley, Humphreys, Meigs, Sevier, Hardin, Carter, and Unicoi (ranging from 170.8 to 301.8/100,000). Six of these were also among the lowest counties in the HDDS inpatient

data. The ten counties with the highest age-adjusted rates of HTN among the elderly were Haywood, Fentress, Houston, Stewart, Lauderdale, Montgomery, Lake, Hardeman, Smith, and Clay (ranging from 862.8/100,000 in Clay to 1,208.8/100,000 in Haywood). Seven of these were also among the highest counties in the HDDS inpatient data.

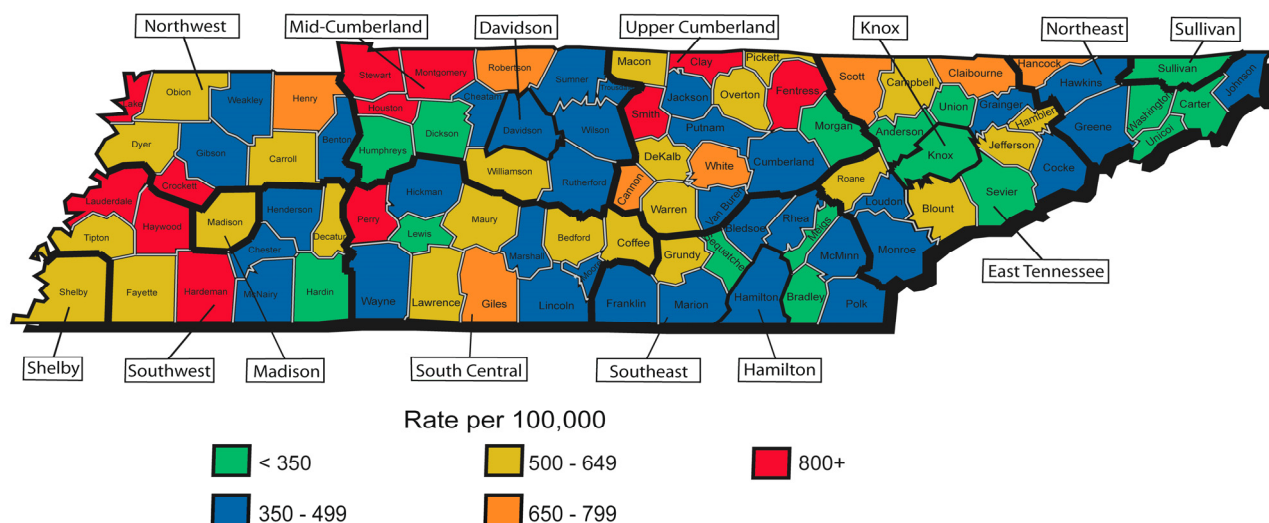


Figure 5.5. Average Age-adjusted Rate of Hypertension by County and Health Service Region, 1998-2002, Tennessee, CMS Inpatient Files

According to CMS carrier (physician) data, the number of patients age 65 and over in Tennessee who were seen by a physician with a primary diagnosis of HTN increased by 31% from 228,599 in 1996 to 298,394 in 2002 (See **Table 5.6 & Figure 5.6.**). Overall, the age-adjusted rates of physician-diagnosed HTN among elderly patients increased by 25% from 31,617.7 per 100,000 to 39,410.7 per 100,000 population from 1996 to 2002. This suggests that the raw increase in patients seen by physicians for HTN was not merely due to an aging population.

The age-adjusted rates of physician-diagnosed HTN among the age 65 and over population were consistently higher for women compared to men, and higher for Blacks compared to Whites. In 2002, among the elderly population, Black females had the highest age-adjusted rate of physician-diagnosed HTN (55,420.2/100,000), followed by White females (42,282.3/100,000), Black males (38,670.9/100,000), and White males with the lowest rate (32,482.6/100,000).

Table 5.6. Frequency and Age-adjusted Rate of Hypertension, 1996-2002, Tennessee, CMS Carrier Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	63,034	67,605	70,984	73,591	78,552	85,598	89,941
White Female	130,118	136,697	141,640	145,381	153,622	164,022	169,061
Black Male	8,927	9,616	9,774	9,835	10,202	10,777	11,041
Black Female	23,009	24,198	24,427	24,381	25,072	26,045	26,638
Total White	193,152	204,302	212,624	218,972	232,174	249,620	259,002
Total Black	31,936	33,814	34,201	34,216	35,274	36,822	37,679
Total Male	72,972	77,889	81,530	84,299	89,194	96,906	101,540
Total Female	155,627	162,737	168,417	172,262	179,770	191,195	196,854
Total	228,599	240,626	249,947	256,561	268,964	288,101	298,394
Age-adjusted Rate Per 100,000							
White Male	24,814.6	26,096.0	27,123.6	27,802.4	29,059.1	31,302.0	32,482.6
White Female	34,026.5	35,257.3	36,353.8	37,109.0	38,599.4	41,090.7	42,282.3
Black Male	31,236.5	33,588.8	34,314.7	34,718.7	35,628.9	37,678.0	38,670.9
Black Female	47,969.2	50,248.2	50,907.1	50,888.6	51,704.4	53,979.7	55,420.2
Total White	30,465.1	31,699.2	32,740.1	33,440.1	34,764.9	37,190.9	38,368.3
Total Black	41,711.9	44,015.2	44,725.5	44,889.4	45,745.8	47,909.7	49,220.6
Total Male	26,927.2	28,382.1	29,466.7	30,112.5	31,557.0	33,869.2	35,027.8
Total Female	37,892.5	39,239.4	40,307.7	41,082.0	42,673.7	45,052.1	45,995.3
Total	31,617.7	32,929.3	33,956.1	34,589.4	35,901.1	38,244.9	39,410.7

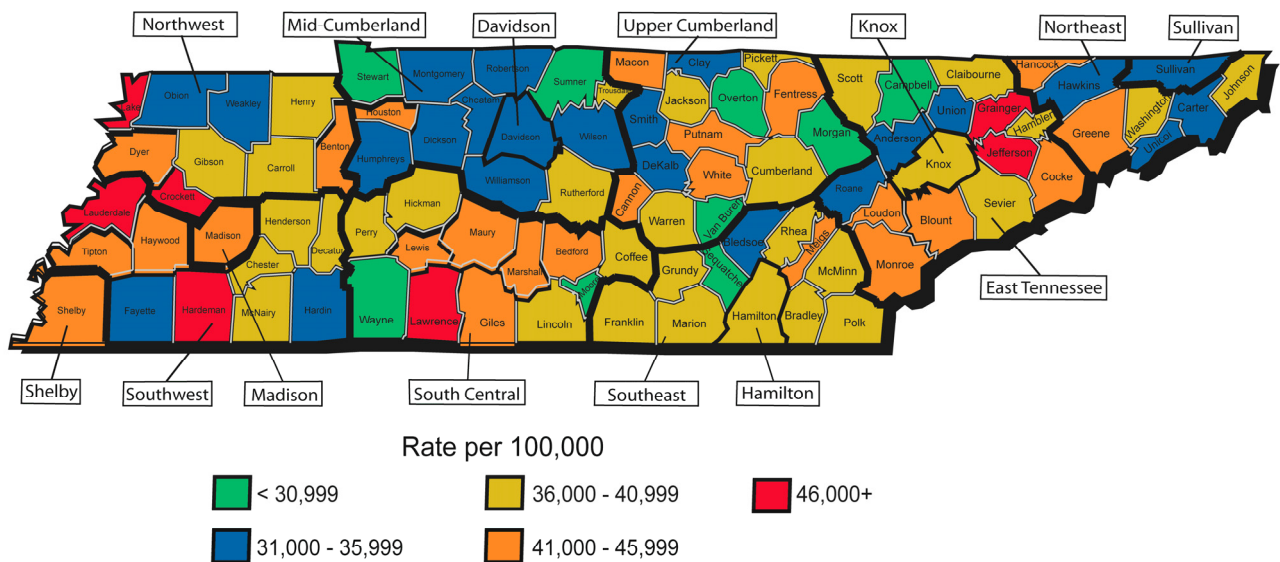


Figure 5.6. Average Age-adjusted Rate of Hypertension by County and Health Service Region, 1998-2002, Tennessee, CMS Carrier Files

Table 5.7. reports the number of deaths and age-adjusted mortality rates from HTN based on the Death Statistical System Summary (DSSS) for Tennessee from 1996 to 2002. The annual number of deaths from HTN in Tennessee increased by 43% from 1,068 to 1,524 during this time period. The age-adjusted mortality rate from HTN increased by 29% from 20.9 to 26.9 per 100,000 deaths from 1996 to 2002 (See **Figure 5.7.**).

Men had slightly higher age-adjusted mortality rates from HTN compared to women in most years (28.0/100,000 and 25.8/100,000, respectively, in 2002). The mortality rates from HTN were more than three times higher for Blacks compared to Whites. In 2002, Black males had the highest HTN mortality rate (81.5/100,000), followed by Black females (61.8/100,000), and very similar rates for White males and females (20.9/100,000 and 20.7/100,000, respectively).

Table 5.7. Number of Deaths and Age-adjusted Mortality Rate from Hypertension, Total Population, 1996-2002, Tennessee, DSSS

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	233	295	285	258	307	374	382
White Female	464	469	473	488	522	677	659
Black Male	160	182	171	172	162	208	215
Black Female	210	251	239	200	243	277	260
Total White	697	764	758	746	829	1,051	1,041
Total Black	370	433	410	372	405	485	475
Total Male	393	479	457	430	472	582	605
Total Female	675	720	716	691	767	958	919
Total	1,068	1,199	1,173	1,121	1,239	1,540	1,524
Age-adjusted Rate Per 100,000							
White Male	14.2	17.3	16.4	14.5	17.2	20.4	20.9
White Female	15.9	15.7	15.6	15.8	16.9	21.4	20.7
Black Male	66.2	74.1	66.1	66.0	56.5	76.4	81.5
Black Female	55.0	64.8	60.3	49.7	59.6	69.0	61.8
Total White	15.7	16.7	16.2	15.8	17.3	21.6	21.0
Total Black	60.1	69.0	63.2	57.0	60.4	72.5	69.1
Total Male	20.1	23.9	22.1	20.2	21.8	26.5	28.0
Total Female	20.6	21.7	21.2	20.0	22.2	27.2	25.8
Total	20.9	22.9	21.9	20.7	22.5	27.6	26.9

Per 100,000

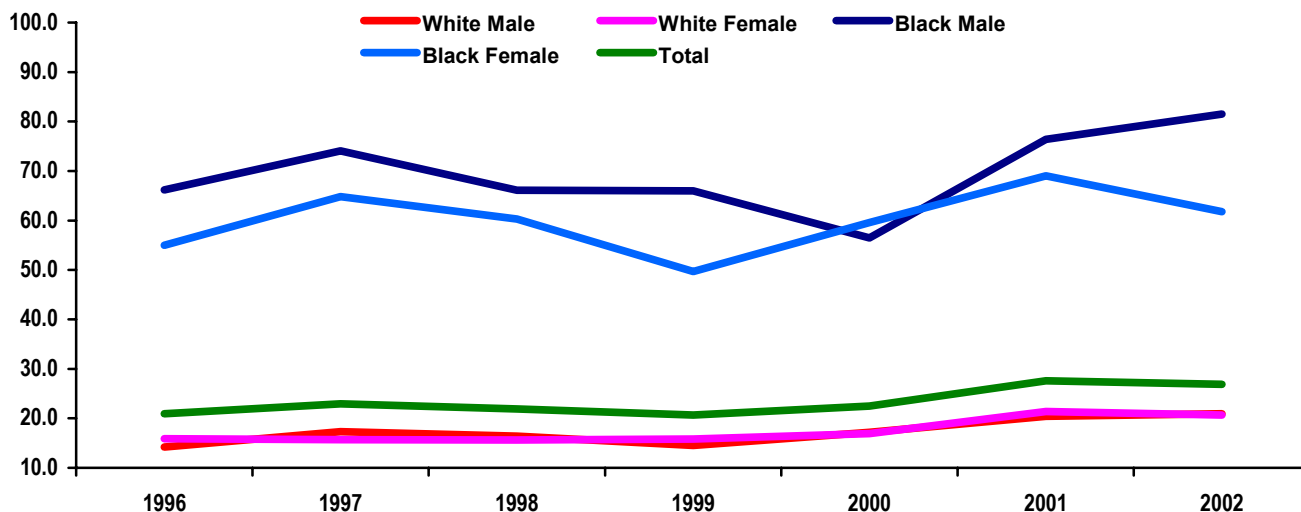


Figure 5.7. Trends in Age-adjusted Mortality Rate from Hypertension, Total Population, 1996-2002, Tennessee, DSSS

Parallel mortality data for the age 65 and over population in Tennessee are presented in **Table 5.8.** and **Figure 5.8.** With an average of about 1000 deaths per year in this age group, about three-fourths of the people who died from HTN each year were age 65 and over. Hence, the HTN death rates in this age group also increased by 31% from 1996 to 2002. Not surprisingly, the age-adjusted mortality rates from HTN for this age group were much higher than the rates for the general population. The age-adjusted mortality rates from HTN for the age 65 and over population in Tennessee increased by 19% from 134.2 to 160.0 per 100,000 deaths during this time period.

As with the total Tennessee population, within the age 65 and over population, men had slightly higher age-adjusted mortality rates from HTN compared to women in most years (160.7/100,000 and 159.1/100,000, respectively, in 2002). The mortality rates from HTN for age 65 and over were two to three times higher for Blacks compared to Whites. In 2002, Black males had the highest HTN mortality rate (408.0/100,000), followed by Black females (318.5/100,000). White females had slightly higher rates than White males (141.6/100,000 and 130.9/100,000, respectively).

Table 5.8. Number of Deaths and Age-adjusted Mortality Rate from Hypertension, Age 65 and Over, 1996-2002, Tennessee, DSSS

GROUP	1996	1997	1998	1999	2000	2001	2002
Frequencies							
White Male	178	225	219	185	232	253	272
White Female	434	432	433	444	460	614	586
Black Male	91	97	76	85	58	98	99
Black Female	154	187	159	142	165	188	162
Total White	612	657	652	629	692	867	858
Total Black	245	284	235	227	223	286	261
Total Male	589	619	595	589	627	804	748
Total Female	269	324	296	270	291	351	373
Total	858	943	891	859	918	1,155	1,121
Age-adjusted Rate Per 100,000							
White Male	93.4	113.2	107.9	91.5	111.9	123.0	130.9
White Female	115.5	112.5	110.5	111.6	114.7	150.6	141.6
Black Male	345.0	377.6	297.6	320.7	220.1	372.0	408.0
Black Female	318.2	383.6	318.5	283.5	330.0	386.6	318.5
Total White	109.4	114.4	111.4	106.2	115.4	142.4	138.2
Total Black	330.9	381.0	311.1	300.6	297.8	381.4	346.1
Total Male	138.8	143.2	134.8	131.5	139.1	175.6	160.7
Total Female	120.8	143.2	128.7	115.1	122.2	146.8	159.1
Total	134.2	144.2	133.9	127.7	135.1	167.6	160.0

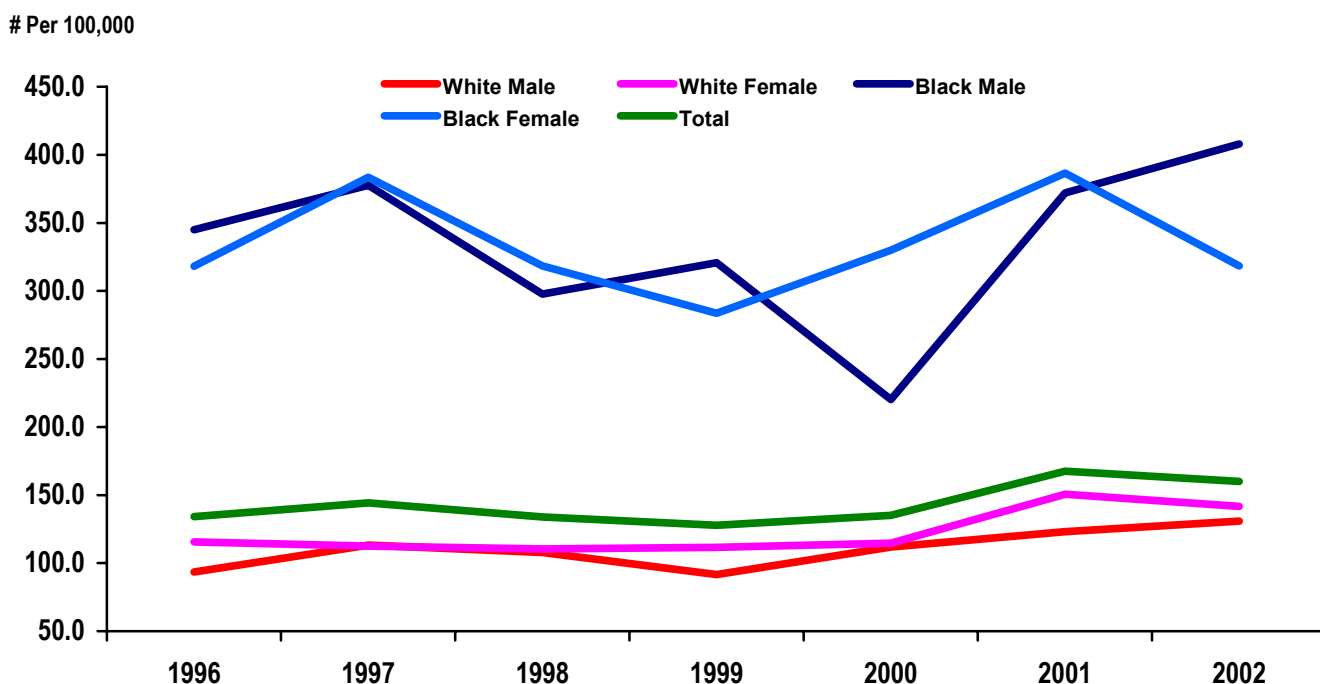


Figure 5.8. Trends in Age-adjusted Mortality Rate from Hypertension, Age 65 and Over, 1996-2002, Tennessee, DSSS

Figure 5.9. is a map of the age-adjusted mortality rates from HTN by county for the total Tennessee population, based on DSSS data (five-year average, 1998-2002). The darker portions of the map reflect higher age-adjusted mortality rates from HTN. The ten counties with the lowest age-adjusted mortality rates from HTN in Tennessee were Lewis, Unicoi, Claiborne, Scott, Decatur, Lawrence, Bledsoe, Pickett, Moore, and Hamblen (ranging from 1.8 to 8.5 /100,000 deaths). The ten counties with the highest age-adjusted mortality rates from HTN were Lauderdale, Hardeman, Shelby, Sevier, Lincoln, Henry, Davidson, Lake, Dyer, and Haywood (ranging from 31.1/100,000 deaths in Haywood to 47.5/100,000 in Lauderdale).

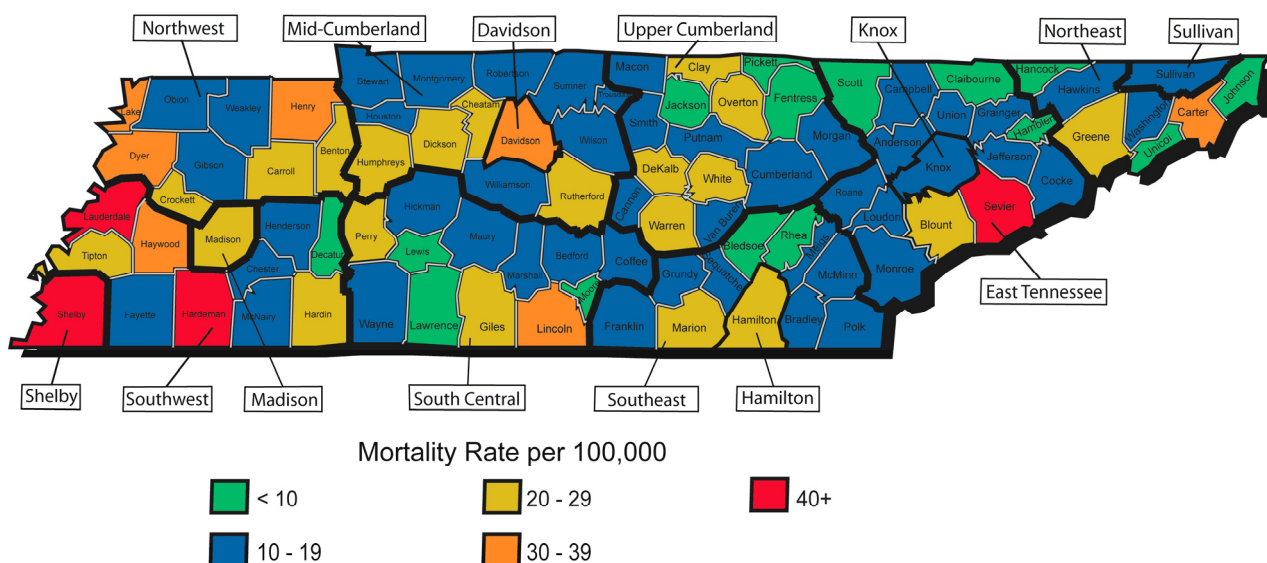


Figure 5.9. Average Age-adjusted Mortality Rate from Hypertension by County and Health Service Region, Total Population, 1998-2002, Tennessee, DSSS

Figure 5.10. is a map of the age-adjusted mortality rates from HTN by county for the age 65 and over population, based on DSSS data (five-year average, 1998-2002). Again, the darker portions of the map reflect higher age-adjusted mortality rates from HTN. The ten counties with the lowest age-adjusted mortality rates from HTN among the elderly in Tennessee were Pickett, Lewis, Claiborne, Unicoi, Trousdale, Scott, Jackson, Lawrence,

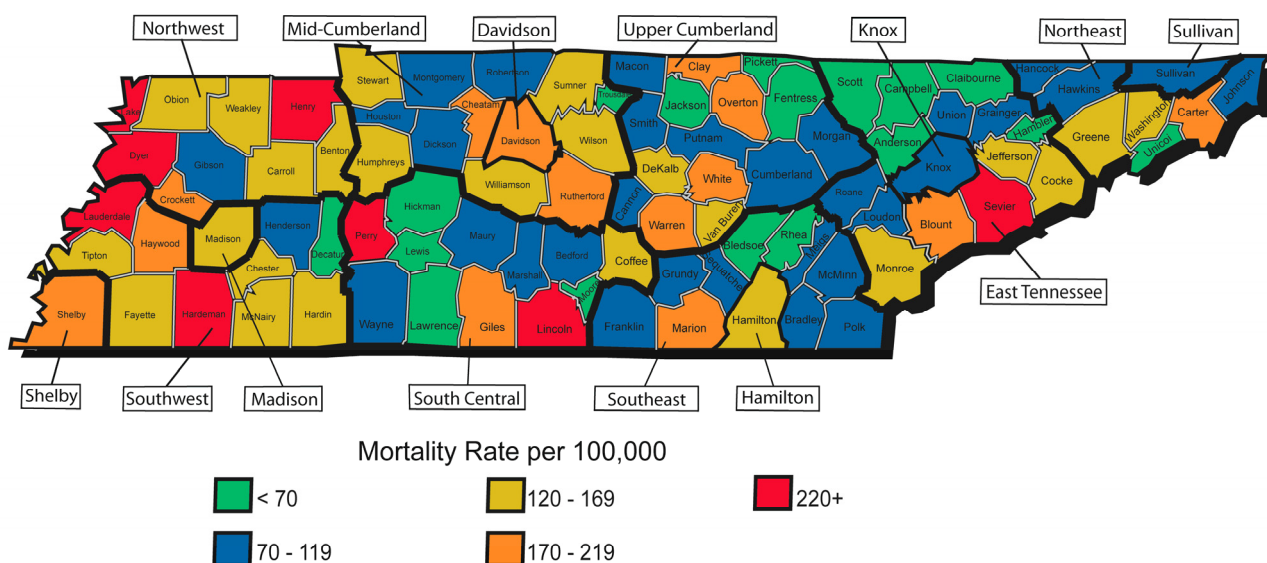


Figure 5.10. Average Age-adjusted Mortality Rate from Hypertension by County and Health Service Region, Age 65 and Over, 1998-2002, Tennessee, DSSS

Decatur, and Hamblen (ranging from 0.0 to 58.0/100,000). Eight of these were also among the lowest counties for mortality from HTN in the total population. The ten counties with the highest age-adjusted rates of HTN among the elderly were Lauderdale, Lincoln, Hardeman, Lake, Sevier, Henry, Perry, Dyer, Carter, and Shelby (ranging from 212.6/100,000 in Shelby to 306.6/100,000 in Lauderdale). Eight of these were also among the highest counties for mortality from HTN in the total population. **Table 5.9.** presents calculations of years of potential life lost (YPLL) due to mortality from HTN based on the DSSS for Tennessee from 1996 to 2002. The total annual YPLL from HTN increased by 92% from 5,813 in 1996 to 11,159 in 2002, with a total YPLL of 58,182 during this time period. Annual YPLL from HTN increased more rapidly for women (102%) compared to men (85%), and more rapidly for Whites (128%) compared to Blacks (64%)

Table 5.9. Years of Potential Life Lost from Hypertension, 1996-2002, Tennessee, DSSS

GROUP	1996	1997	1998	1999	2000	2001	2002	Total
White Male	1,483	1,918	1,853	1,970	2,142	3,232	3,067	15,665
White Female	844	1,074	1,009	1,223	1,636	1,623	2,230	9,639
Black Male	1,972	2,410	2,575	2,341	2,886	3,143	3,168	18,495
Black Female	1,514	1,771	2,122	1,562	2,258	2,337	2,540	14,104
Total White	2,327	2,992	2,862	3,193	3,778	4,855	5,297	25,304
Total Black	3,486	4,181	4,697	3,903	5,144	5,480	5,708	32,599
Total Female	2,358	2,845	3,156	2,795	3,898	3,995	4,770	23,817
Total Male	3,455	4,328	4,428	4,311	5,079	6,375	6,389	34,365
Total	5,813	7,173	7,584	7,106	8,977	10,370	11,159	58,182

VI. IMPACT ON HEALTH SERVICE UTILIZATION

A. Service Utilization Patterns

Tables 6.1 – 6.3 report the number of inpatient hospitalizations for DOH, stroke, and HTN, as well as the percentage of all inpatient hospitalizations that are comprised by each of these conditions in the Tennessee population, according to event-level HDDS inpatient data. For DOH, the total annual number of inpatient visits increased by 11% from 81,220 to 90,458 from 1997 to 2002 (See Fig 6.1). The number of inpatient visits for DOH increased by 11% for Whites compared to 3% for Blacks, while the increase was similar for males and females. During this time period, DOH consistently accounted for around 12% of all inpatient visits. The percentage of DOH inpatient visits tended to be higher for males compared to females, and slightly higher for Whites compared to Blacks (See Table 6.1).

Table 6.1. Inpatient Hospitalizations with Primary Diagnosis of Diseases of the Heart, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Number of Hospitalizations						
White Male	34,989	35,340	36,803	36,738	36,953	38,199
White Female	31,099	31,693	32,235	33,236	33,944	35,023
Black Male	5,461	6,215	4,844	4,711	4,895	5,568
Black Female	6,863	7,424	6,634	6,001	6,266	7,123
Total White	66,099	67,058	69,056	69,979	70,897	73,222
Total Black	12,325	13,649	11,480	10,713	11,161	12,691
Total Female	39,270	41,232	40,606	41,848	43,438	44,188
Total Male	41,938	44,267	43,862	44,614	45,541	46,270
Total	81,220	85,536	84,489	86,468	88,979	90,458
Percentage of All Hospitalizations						
White Male	17.0%	16.9%	16.7%	16.6%	16.1%	16.0%
White Female	10.3%	10.2%	9.9%	10.0%	9.9%	9.8%
Black Male	12.0%	12.6%	10.9%	11.0%	11.0%	11.7%
Black Female	9.3%	9.0%	8.9%	8.5%	8.6%	9.0%
Total White	13.0%	12.9%	12.6%	12.7%	12.4%	12.3%
Total Black	10.3%	10.4%	9.6%	9.4%	9.5%	10.0%
Total Female	9.9%	9.7%	9.5%	9.7%	9.6%	9.5%
Total Male	15.9%	15.7%	15.5%	15.7%	15.4%	15.3%
Total	12.3%	12.1%	11.9%	12.1%	11.9%	11.8%

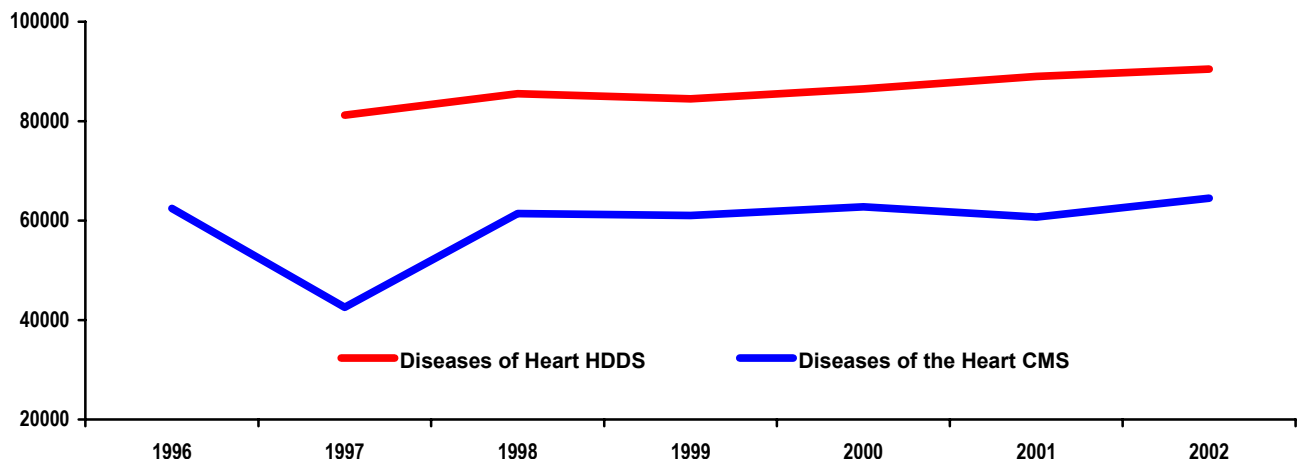


Figure 6.1. Trends in Inpatient Utilization Diseases of the Heart, 1996/7-2002, Tennessee, HDDS & CMS Inpatient Files

For stroke, the total annual number of inpatient visits increased by 8% from 21,120 to 22,844 from 1997 to 2002 (See Figure 6.2). The number of inpatient visits for stroke increased by 12% for Whites compared to 7% for Blacks, and increased by 10% for males compared to 6% for females. During this time period, stroke consistently accounted for around 3% of all inpatient visits, with little difference by race or gender (See Table 6.2).

Table 6.2. Inpatient Hospitalizations with Primary Diagnosis of Stroke, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Number of Hospitalizations						
White Male	7,386	7,542	7,513	7,600	7,904	7,748
White Female	9,346	9,558	9,719	9,653	9,783	10,211
Black Male	1,373	1,486	1,321	1,231	1,396	1,493
Black Female	2,002	2,330	1,963	1,905	1,969	2,284
Total White	16,738	17,109	17,238	17,256	17,687	17,959
Total Black	3,375	3,818	3,284	3,137	3,365	3,777
Total Male	9,212	9,627	9,372	9,542	10,064	9,745
Total Female	11,912	12,549	12,331	12,410	12,736	13,099
Total	21,130	22,188	21,709	21,956	22,800	22,844
Percentage of All Hospitalizations						
White Male	3.6%	3.6%	3.4%	3.4%	3.4%	3.2%
White Female	3.1%	3.1%	3.0%	2.9%	2.9%	2.8%
Black Male	3.0%	3.0%	3.0%	2.9%	3.1%	3.1%
Black Female	2.7%	2.8%	2.6%	2.7%	2.7%	2.9%
Total White	3.3%	3.3%	3.2%	3.1%	3.1%	3.0%
Total Black	2.8%	2.9%	2.8%	2.8%	2.9%	3.0%
Total Male	3.5%	3.4%	3.3%	3.4%	3.4%	3.2%
Total Female	3.0%	3.0%	2.9%	2.9%	2.8%	2.8%
Total	3.2%	3.1%	3.1%	3.1%	3.0%	3.0%

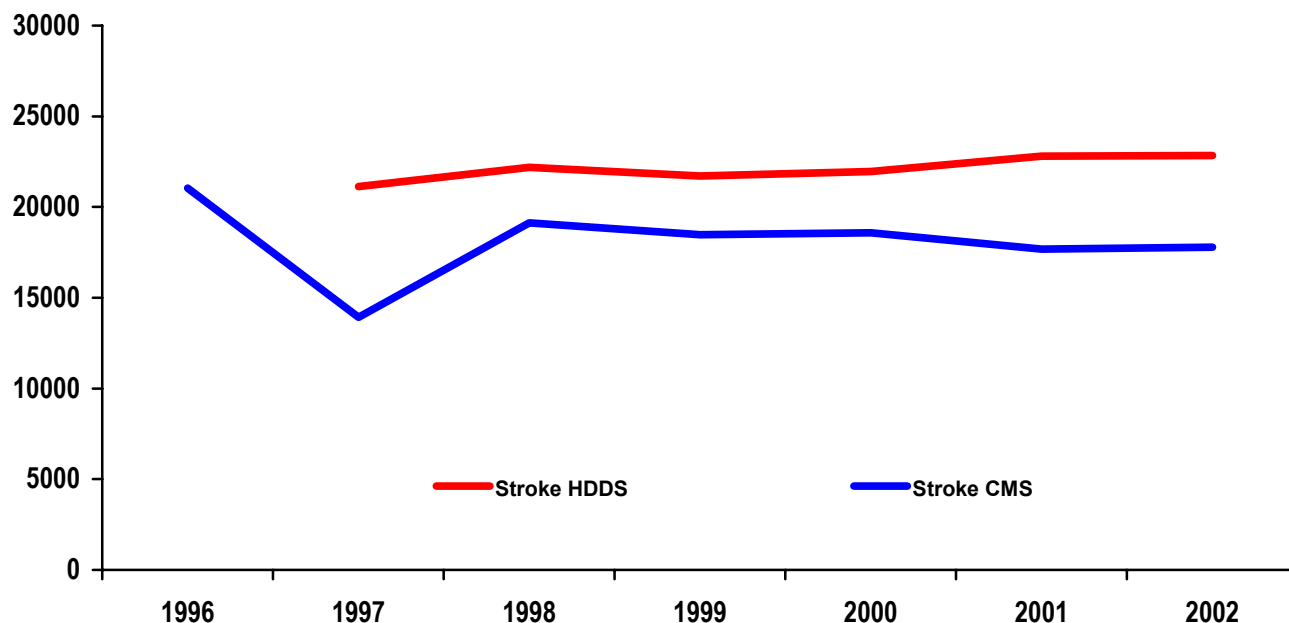


Figure 6.2. Trends in Inpatient Utilization Stroke, 1996/7-2002, Tennessee, HDDS & CMS Inpatient Files

For HTN, the total annual number of inpatient visits increased by 4% from 6,852 to 7,091 from 1997 to 2002 (see Figure 6.3). The number of inpatient visits for HTN increased by 12% for Blacks but decreased by 2% for Whites, while the increase was similar for males and females. During this time period, HTN consistently accounted for around 1% of all inpatient visits. The percentage of HTN inpatient visits tended to be slightly higher for Blacks compared to Whites (See Table 6.3).

Table 6.3. Inpatient Hospitalizations with Primary Diagnosis of Hypertension, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Number of Hospitalizations						
White Male	1,585	1,528	1,398	1,591	1,640	1,491
White Female	2,570	2,427	2,360	2,599	2,770	2,591
Black Male	993	988	965	1,058	1,097	1,139
Black Female	1,445	1,380	1,395	1,328	1,541	1,585
Total White	4,155	3,957	3,762	4,191	4,410	4,082
Total Black	2,438	2,370	2,361	2,386	2,638	2,724
Total Male	2,674	2,720	2,485	2,804	2,906	2,754
Total Female	4,178	4,046	3,923	4,173	4,611	4,337
Total	6,852	6,770	6,414	6,978	7,517	7,091
Percentage of All Hospitalizations						
White Male	0.8%	0.7%	0.6%	0.7%	0.7%	0.6%
White Female	0.9%	0.8%	0.7%	0.8%	0.8%	0.7%
Black Male	2.2%	2.0%	2.2%	2.5%	2.5%	2.4%
Black Female	2.0%	1.7%	1.9%	1.9%	2.1%	2.0%
Total White	0.8%	0.8%	0.7%	0.8%	0.8%	0.7%
Total Black	2.0%	1.8%	2.0%	2.1%	2.3%	2.2%
Total Male	1.0%	1.0%	0.9%	1.0%	1.0%	0.9%
Total Female	1.1%	1.0%	0.9%	1.0%	1.0%	0.9%
Total	1.0%	1.0%	0.9%	1.0%	1.0%	0.9%

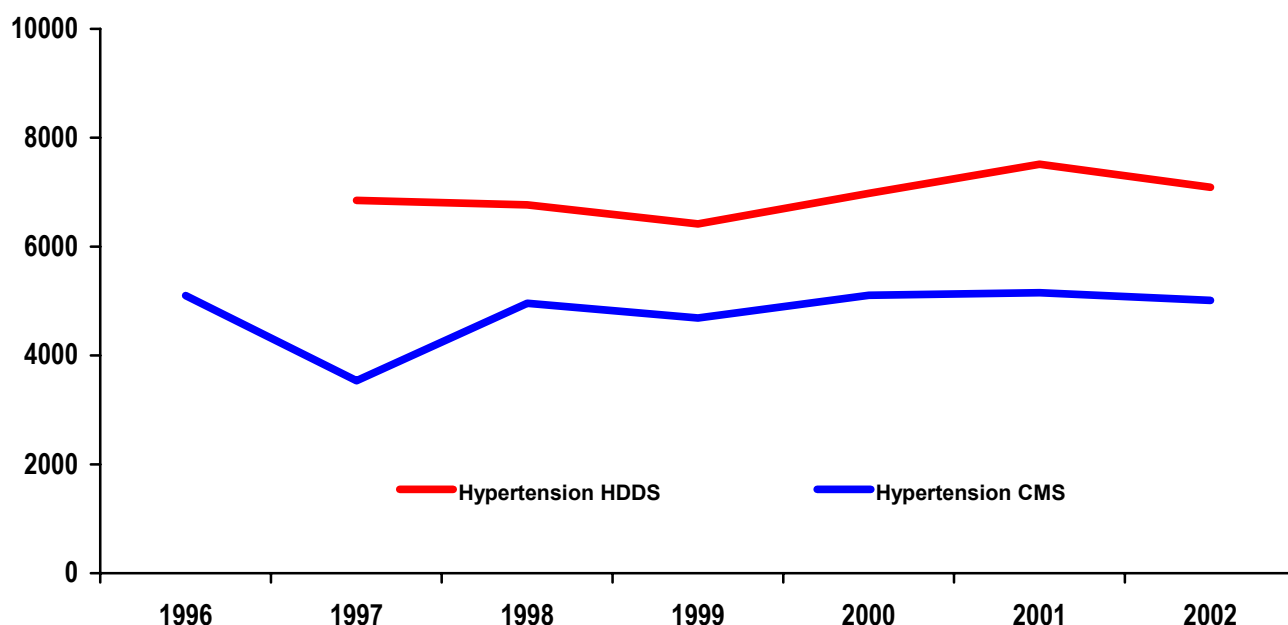


Figure 6.3. Trends in Inpatient Utilization Hypertension, 1996/7-2002, Tennessee, HDDS & CMS Inpatient Files

Tables 6.4 - 6.6 report the number of inpatient hospitalizations for DOH, stroke, and HTN, as well as the percentage of all inpatient hospitalizations that are comprised by each of these conditions in the Tennessee population age 65 and over, according to event-level CMS inpatient data. For DOH, the total annual number of inpatient visits increased by 5% from 62,459 to 64,474 from 1996 to 2002 (See Figure 6.1). The number of inpatient visits for DOH increased by 25% for Blacks compared to 3% for Whites, while the increase was similar for males and females. During this time period, DOH consistently accounted for around 18-19% of all inpatient visits. The percentage of DOH inpatient visits tended to be higher for males compared to females, and slightly higher for Whites compared to Blacks (See Table 6.4).

Table 6.4. Inpatient Hospitalizations with Primary Diagnosis of Diseases of the Heart, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Number of Hospitalizations							
White Male	25,729	17,666	25,175	24,992	25,823	24,647	26,093
White Female	28,588	19,898	27,979	27,766	28,565	28,003	29,408
Black Male	2,725	1,624	2,884	2,727	2,882	2,801	3,204
Black Female	4,385	2,705	4,530	4,673	4,483	4,401	4,976
White	54,317	37,564	53,154	52,758	54,388	52,650	55,501
Black	7,110	4,329	7,414	7,400	7,365	7,202	8,180
Male	28,918	19,579	28,424	28,115	29,103	27,799	29,624
Female	33,541	22,972	32,995	32,912	33,674	32,883	34,849
Total	62,459	42,551	61,419	61,027	62,777	60,682	64,474
Percentage of All Hospitalizations							
	1996	1997	1998	1999	2000	2001	2002
White Male	21.6%	21.5%	21.2%	21.0%	21.2%	20.9%	20.6%
White Female	17.7%	17.6%	17.2%	16.9%	16.9%	16.9%	16.5%
Black Male	15.6%	16.0%	16.3%	15.7%	16.0%	15.8%	16.3%
Black Female	18.0%	17.3%	17.6%	17.8%	16.9%	17.0%	17.6%
White	19.4%	19.2%	18.9%	18.7%	18.7%	18.6%	18.2%
Black	17.0%	16.8%	17.1%	16.9%	16.5%	16.5%	17.0%
Male	20.7%	20.8%	20.5%	20.3%	20.5%	20.2%	20.0%
Female	17.7%	17.5%	17.2%	17.0%	20.5%	16.9%	16.7%
Total	19.0%	18.9%	18.6%	18.4%	18.4%	18.3%	18.0%

For stroke, the total annual number of inpatient visits decreased by 23% from 21,047 to 17,789 from 1996 to 2002 (See Figure 6.2). The number of inpatient visits for stroke decreased by 24% for Whites compared to 12% for Blacks, and decreased by 28% for males compared to 20% for females. During this time period, stroke consistently accounted for around 5-6% of all inpatient visits, with little difference by race or gender (See Table 6.5).

Table 6.5. Inpatient Hospitalizations with Primary Diagnosis of Stroke, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Number of Hospitalizations							
White Male	7,596	5,104	6,863	6,436	6,589	6,300	6,107
White Female	10,402	7,056	9,416	9,206	9,199	8,596	8,912
Black Male	1,007	581	936	928	913	931	934
Black Female	1,740	1,032	1,686	1,634	1,609	1,622	1,628
White	17,998	12,160	16,279	15,642	15,788	14,896	15,019
Black	2,747	1,613	2,622	2,562	2,522	2,553	2,562
Male	8,705	5,741	7,864	7,455	7,585	7,314	7,116
Female	12,342	8,186	11,260	11,019	11,001	10,372	10,673
Total	21,047	13,927	19,124	18,474	18,586	17,687	17,789
Percentage of All Hospitalizations							
White Male	6.4%	6.2%	5.8%	5.4%	5.4%	5.4%	4.8%
White Female	6.4%	6.2%	5.8%	5.6%	5.4%	5.2%	5.0%
Black Male	5.8%	5.7%	5.3%	5.3%	5.1%	5.2%	4.7%
Black Female	7.1%	6.6%	6.5%	6.2%	6.1%	6.3%	5.7%
White	6.4%	6.2%	5.8%	5.5%	5.4%	5.3%	4.9%
Black	6.6%	6.3%	6.0%	5.9%	5.7%	5.9%	5.3%
Male	6.2%	6.1%	5.7%	5.4%	5.3%	5.3%	4.8%
Female	6.5%	6.2%	5.9%	5.7%	5.5%	5.3%	5.1%
Total	6.4%	6.2%	5.8%	5.6%	5.4%	5.3%	5.0%

For HTN, the total annual number of inpatient visits decreased by 3% from 5,101 to 5,041 from 1996 to 2002 (See Figure 6.3). The number of inpatient visits for HTN increased by 13% for Blacks but decreased by 7% for Whites, and decreased by 6% for males compared to 1% for females. During this time period, HTN consistently

accounted for around 1.5% of all inpatient visits. The percentage of HTN inpatient visits tended to be higher for Blacks compared to Whites (See Table 6.6).

Table 6.6. Inpatient Hospitalizations with Primary Diagnosis of Hypertension, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Number of Hospitalizations							
White Male	1,247	918	1,247	1,040	1,188	1,193	1,086
White Female	2,210	1,630	2,195	2,095	2,256	2,306	2,199
Black Male	572	337	553	538	598	573	661
Black Female	943	577	855	900	918	993	976
White	3,457	2,548	3,442	3,135	3,444	3,499	3,285
Black	1,515	914	1,408	1,438	1,516	1,566	1,637
Male	1,858	1,276	1,831	1,620	1,835	1,797	1,784
Female	3,243	2,262	3,127	3,068	3,268	3,356	3,229
Total	5,101	3,538	4,958	4,688	5,103	5,153	5,014
Percentage of All Hospitalizations							
White Male	1.0%	1.1%	1.1%	.9%	1.0%	1.0%	.9%
White Female	1.4%	1.4%	1.4%	1.3%	1.3%	1.4%	1.2%
Black Male	3.3%	3.3%	3.1%	3.1%	3.3%	3.2%	3.4%
Black Female	3.9%	3.7%	3.3%	3.4%	3.5%	3.8%	3.4%
White	1.2%	1.3%	1.2%	1.1%	1.2%	1.2%	1.1%
Black	3.6%	3.5%	3.2%	3.3%	3.4%	3.6%	3.4%
Male	1.3%	1.4%	1.3%	1.2%	1.3%	1.3%	1.2%
Female	1.7%	1.7%	1.6%	1.6%	1.6%	1.7%	1.5%
Total	1.6%	1.6%	1.5%	1.4%	1.5%	1.6%	1.4%

Tables 6.7 – 6.9 report the mean length of stay (LOS) and total days of stay for inpatient hospitalizations in the Tennessee population by condition, according to event-level HDDS inpatient data. For DOH, the average LOS decreased by 3% from 5.3 to 5.1 days from 1997 to 2002. The total annual number of inpatient days for DOH increased by 8% from 427,038 to 459,879 during this time period. LOS for DOH tended to be slightly longer for females compared to males, and about a day longer for Blacks compared to Whites. In 2002 LOS for DOH was longest for Black women (6.3), second highest for Black men (5.8), followed by White women (5.0), and lowest for White men (4.7) (See Figure 6.4).

Table 6.7. Length of Stay for Inpatient Hospitalizations with Primary Diagnosis of Diseases of the Heart, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Diseases of the Heart: Number of Days						
White Male	174,607	173,837	173,064	173,418	171,871	180,362
White Female	164,336	164,014	161,721	164,834	167,621	175,858
Black Male	31,812	36,243	27,588	25,465	27,903	32,327
Black Female	42,295	44,977	40,497	36,919	36,957	44,896
Total White	338,994	337,941	334,888	338,313	339,492	356,220
Total Black	74,109	81,261	68,113	62,385	64,860	77,223
Total Male	213,882	223,589	211,565	216,654	220,422	227,131
Total Female	213,103	219,783	211,760	217,639	223,229	232,748
Total	427,038	443,514	423,467	434,355	443,651	459,879
Diseases of the Heart: Mean Number of Days						
White Male	5.0	4.9	4.7	4.7	4.7	4.7
White Female	5.3	5.2	5.0	5.0	4.9	5.0
Black Male	5.8	5.8	5.7	5.4	5.7	5.8
Black Female	6.2	6.1	6.1	6.2	5.9	6.3
Total White	5.1	5.0	4.8	4.8	4.8	4.9
Total Black	6.0	6.0	5.9	5.8	5.8	6.1
Total Male	5.1	5.1	4.8	4.9	4.8	4.9
Total Female	5.4	5.3	5.2	5.2	5.1	5.3
Total	5.3	5.2	5.0	5.0	5.0	5.1

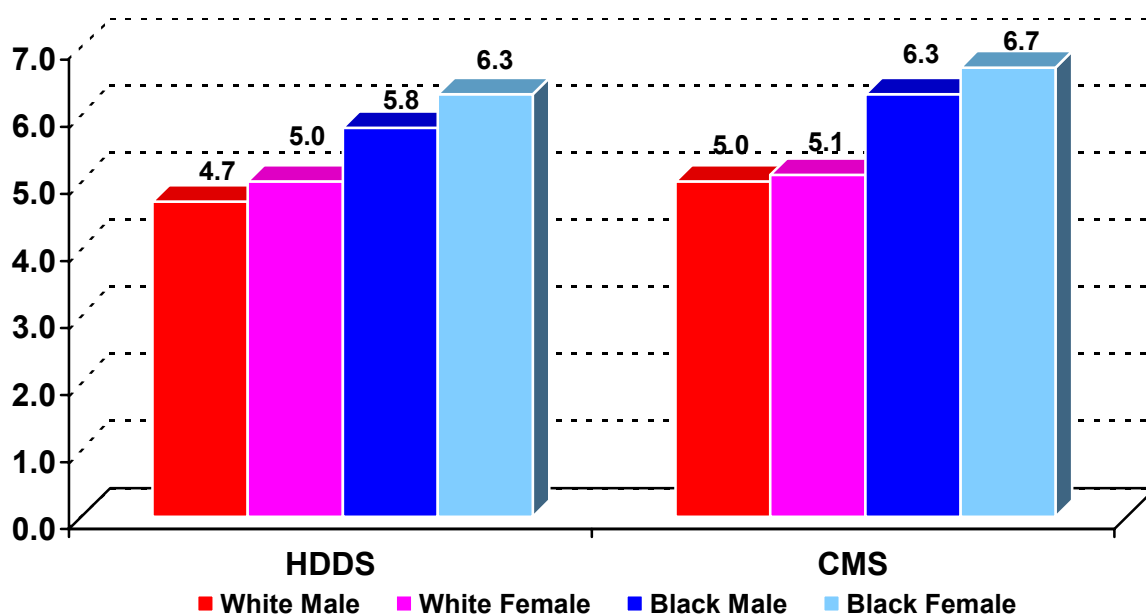


Figure 6.4. Mean Number of Inpatient Days, Primary Diagnoses of Diseases of the Heart, 2002, Tennessee, HDDS & CMS Inpatient Files

For stroke, the average LOS increased by 7% from 5.7 to 6.0 days from 1997 to 2002 (See Figure 6.5). The total annual number of inpatient days for stroke increased by 15% from 119,651 to 137,839 during this time period. LOS for stroke tended to be slightly longer for females compared to males, and two to three days longer for Blacks compared to Whites. Notably, the average LOS for stroke for Blacks increased by 20% compared to 5% for Whites during this time period. In 2002 LOS for stroke was longest for Black women (8.6), second highest for Black men (8.5), followed by White women (5.5), and lowest for White men (5.4) (See Table 6.8).

Table 6.8. Length of Stay for Inpatient Hospitalizations with Primary Diagnosis of Stroke, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Stroke: Number of Days						
White Male	36,651	40,230	39,853	39,652	42,907	41,902
White Female	49,864	53,338	53,343	52,846	56,104	56,651
Black Male	9,754	11,178	10,191	9,170	11,526	12,671
Black Female	14,284	17,983	15,764	14,339	15,550	19,690
Total White	86,536	93,721	93,230	92,519	99,011	98,553
Total Black	24,038	29,173	25,955	23,516	27,076	32,361
Total Male	50,576	55,020	52,914	53,288	58,693	57,768
Total Female	69,054	75,332	73,226	72,399	77,428	80,071
Total	119,651	130,524	126,174	125,715	136,121	137,839
Stroke: Mean Number of Days						
White Male	5.0	5.3	5.3	5.2	5.4	5.4
White Female	5.3	5.6	5.5	5.5	5.7	5.5
Black Male	7.1	7.5	7.7	7.4	8.3	8.5
Black Female	7.1	7.7	8.0	7.5	7.9	8.6
Total White	5.2	5.5	5.4	5.4	5.6	5.5
Total Black	7.1	7.6	7.9	7.5	8.0	8.6
Total Male	5.5	5.7	5.6	5.6	5.8	5.9
Total Female	5.8	6.0	5.9	5.8	6.1	6.1
Total	5.7	5.9	5.8	5.7	6.0	6.0

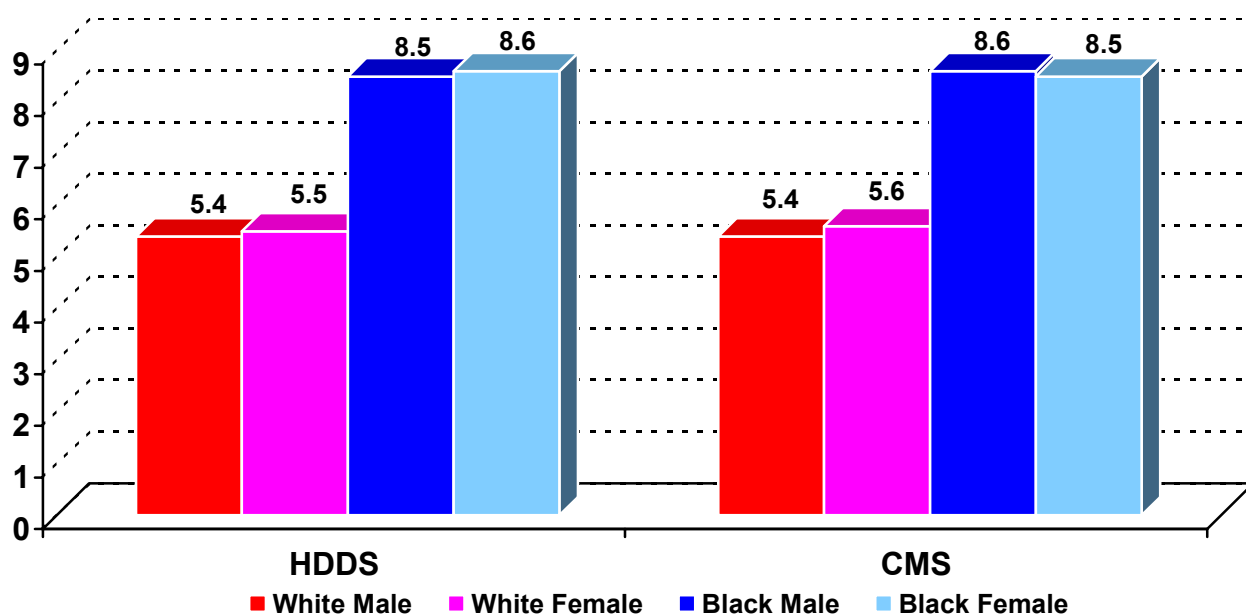


Figure 6.5. Mean Number of Inpatient Days, Primary Diagnoses of Stroke, 2002, Tennessee, HDDS & CMS Inpatient Files

For HTN, the average LOS remained stable around 5.0-5.2 days from 1997 to 2002 (See Figure 6.6). The total annual number of inpatient days for HTN increased by 3% from 35,932 to 37,039 during this time period. LOS for HTN tended to be slightly longer for females compared to males, and slightly longer for Blacks compared to Whites. Notably, the average LOS for HTN for Black females increased by 9% while it decreased by 8% for White females during this time period. In 2002 LOS for HTN was longest for Black women (6.0), second highest for Black men (5.3), followed by White men (5.0), and lowest for White women (4.8) (See Table 6.8).

Table 6.9. Length of Stay for Inpatient Hospitalizations with Primary Diagnosis of Hypertension, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Hypertension: Number of Days						
GROUP	1997	1998	1999	2000	2001	2002
White Male	7,899	7,759	6,493	7,736	8,165	7,453
White Female	13,502	12,171	11,585	12,791	13,790	12,520
Black Male	5,387	5,296	4,918	5,296	5,660	6,008
Black Female	7,947	7,436	7,781	7,160	8,419	9,504
Total White	21,401	19,938	18,104	20,534	21,955	19,973
Total Black	13,334	12,739	12,703	12,456	14,079	15,512
Total Male	13,682	13,972	12,017	13,730	14,686	14,191
Total Female	22,250	20,699	20,258	21,162	23,649	22,848
Total	35,932	34,686	32,308	34,899	38,335	37,039
Hypertension: Mean Number of Days						
White Male	5.0	5.1	4.6	4.9	5.0	5.0
White Female	5.3	5.0	4.9	4.9	5.0	4.8
Black Male	5.4	5.4	5.1	5.0	5.2	5.3
Black Female	5.5	5.4	5.6	5.4	5.5	6.0
Total White	5.2	5.0	4.8	4.9	5.0	4.9
Total Black	5.5	5.4	5.4	5.2	5.3	5.7
Total Male	5.1	5.1	4.8	4.9	5.1	5.2
Total Female	5.3	5.1	5.2	5.1	5.1	5.3
Total	5.2	5.1	5.0	5.0	5.1	5.2

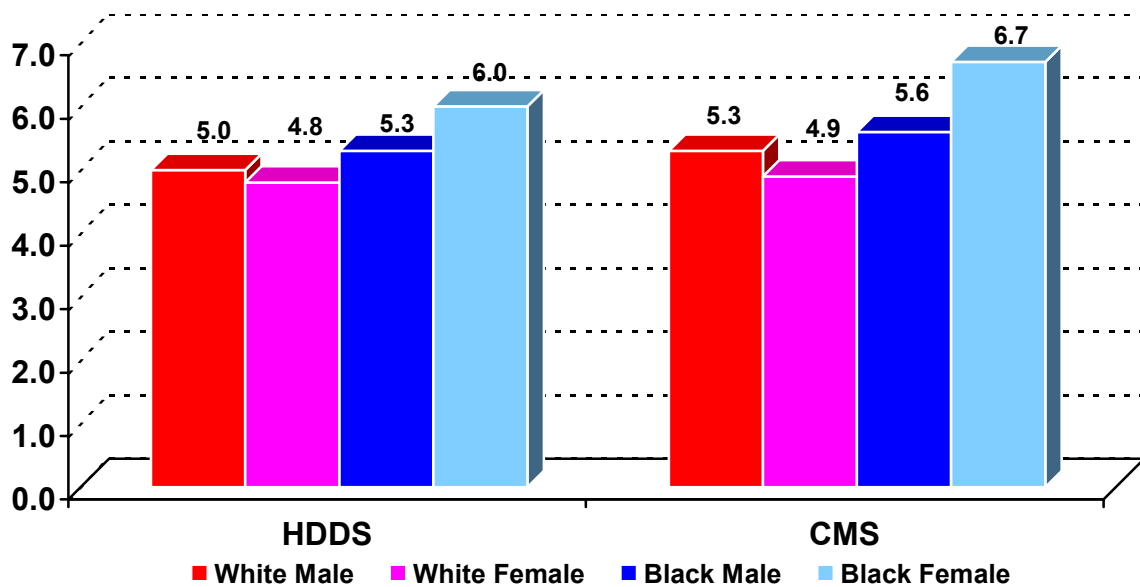


Figure 6.6. Mean Number of Inpatient Days, Primary Diagnoses of Hypertension, 2002, Tennessee, HDDS & CMS Inpatient Files

Tables 6.10-6.12 present the mean length of stay (LOS) and total days of stay for inpatient hospitalizations in the Tennessee age 65 and over population by condition, according to event-level CMS inpatient data. For DOH, the average LOS among the elderly decreased by 4% from 5.5 to 5.3 days from 1996 to 2002, which was slightly higher than the LOS for the total population (See Figure 6.4). The total annual number of inpatient days for DOH among those age 65 and over decreased by 1% from 340,784 to 338,513 during this time period. LOS for DOH tended to be slightly longer for elderly females compared to elderly males, and 1-1.5 days longer for elderly Blacks compared to elderly Whites. In 2002 LOS for DOH among the age 65 and over population was longest for Black women (6.7), second highest for Black men (6.3), followed by White women (5.1), and lowest for White men (5.0) (See Table 6.10).

Table 6.10. Length of Stay for Inpatient Hospitalizations with Primary Diagnosis of Diseases of the Heart, 1996-2002, Tennessee, CMS Inpatient Files

Group	1996	1997	1998	1999	2000	2001	2002
Diseases Of The Heart: Number of Days							
White Male	134,338	90,676	129,817	123,455	125,547	118,983	129,369
White Female	154,117	105,965	146,637	142,831	145,443	140,947	151,075
Black Male	17,261	9,448	18,332	16,986	18,058	17,993	20,237
Black Female	29,626	17,051	28,879	29,655	29,635	27,896	33,486
White	288,455	196,641	276,454	266,286	270,990	259,930	280,444
Black	46,887	26,499	47,211	46,641	47,693	45,889	53,723
Male	153,873	101,621	149,939	142,231	145,507	138,748	151,154
Female	186,911	125,097	178,238	174,873	178,560	171,439	187,359
Total	340,784	226,718	328,177	317,104	324,067	310,187	338,513
Diseases Of The Heart: Mean Number of Days							
White Male	5.1	5.1	5.2	4.9	4.9	4.8	5.0
White Female	5.2	5.3	5.2	5.1	5.1	5.0	5.1
Black Male	6.2	5.8	6.4	6.2	6.3	6.4	6.3
Black Female	6.5	6.3	6.4	6.3	6.6	6.3	6.7
White	5.3	5.2	5.2	5.0	5.0	4.9	5.1
Black	6.6	6.1	6.4	6.3	6.5	6.4	6.6
Male	5.3	5.2	5.3	5.1	5.0	5.0	5.1
Female	5.6	5.4	5.4	5.3	5.3	5.2	5.4
Total	5.5	5.3	5.3	5.2	5.2	5.1	5.3

For stroke, the average LOS for the age 65 and over population increased by 3% from 5.8 to 6.0 days from 1996 to 2002, which is similar to the LOS for the total population (See Figure 6.5). The total annual number of inpatient days for stroke among the elderly decreased by 21% from 122,362 to 106,009 during this time period. LOS for

stroke tended to be slightly longer for elderly females compared to elderly males, and two to three days longer for elderly Blacks compared to elderly Whites. Notably, the average LOS for stroke for elderly Blacks increased by 15% compared to a 2% decrease for elderly Whites during this time period. In 2002 LOS for stroke among the age 65 and over population was longest for Black men (8.6), second highest for Black women (8.5), followed by White women (5.6), and lowest for White men (5.4) (See Table 6.11).

Table 6.11. Length of Stay for Inpatient Hospitalizations with Primary Diagnosis of Stroke, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Stroke: Number of Days							
White Male	41,445	26,539	36,621	34,969	34,938	31,979	32,862
White Female	58,761	39,373	52,316	52,202	51,280	46,134	49,953
Black Male	7,615	4,332	6,844	7,241	7,116	7,360	8,052
Black Female	12,822	7,390	12,785	12,728	12,257	12,001	13,848
White	100,206	65,912	88,937	87,171	86,218	78,113	82,815
Black	20,437	11,722	19,629	19,969	19,373	19,361	21,900
Male	49,631	31,195	43,874	42,726	42,433	39,844	41,297
Female	72,731	47,391	66,309	65,978	64,624	59,006	64,712
Total	122,362	78,586	110,183	108,704	107,057	98,850	106,009
Stroke: Mean Number of Days							
White Male	5.5	5.2	5.3	5.4	5.3	5.1	5.4
White Female	5.6	5.6	5.6	5.7	5.6	5.4	5.6
Black Male	7.6	7.5	7.3	7.8	7.8	7.9	8.6
Black Female	7.4	7.2	7.6	7.8	7.6	7.4	8.5
White	5.6	5.4	5.5	5.6	5.5	5.2	5.5
Black	7.4	7.3	7.5	7.8	7.7	7.6	8.5
Male	5.7	5.4	5.6	5.7	5.6	5.4	5.8
Female	5.9	5.8	5.9	6.0	5.9	5.7	6.1
Total	5.8	5.6	5.8	5.9	5.8	5.6	6.0

For HTN, the average LOS for the age 65 and over population decreased by 2% from 5.6 to 5.5 days from 1996 to 2002, which was slightly higher than the LOS for the total population (See Figure 6.6). The total annual number of inpatient days for HTN among the elderly decreased by 5% from 28,392 to 27,339 during this time period. LOS for HTN tended to be slightly longer for elderly females compared to males, and about a day longer for elderly Blacks compared to elderly Whites. Notably, the average LOS for HTN for elderly Black males declined by 10% during this time period. In 2002 LOS for HTN among the age 65 and over population was longest for Black women (6.6), second highest for Black men (5.6), followed by White men (5.3), and lowest for White women (4.9) (See Table 6.12).

Table 6.12. Length of Stay for Inpatient Hospitalizations with Primary Diagnosis of Hypertension, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Hypertension: Number of Days							
White Male	6,401	4,791	6,597	5,228	5,770	6,203	5,807
White Female	11,469	8,988	11,338	10,707	11,340	11,825	10,867
Black Male	3,524	1,853	3,022	3,098	3,360	3,458	3,715
Black Female	6,173	3,373	5,177	5,490	5,130	5,863	6,504
White	17,870	13,779	17,935	15,935	17,110	18,028	16,674
Black	9,697	5,226	8,199	8,588	8,490	9,321	10,219
Male	10,241	6,760	9,761	8,457	9,432	9,859	9,632
Female	18,151	12,739	16,904	16,526	16,955	17,954	17,707
Total	28,392	19,499	26,665	24,983	26,387	27,813	27,339

Table 6.12. Continued

GROUP	1996	1997	1998	1999	2000	2001	2002
Hypertension: Mean Number of Days							
White Male	5.1	5.2	5.3	5.0	4.9	5.2	5.3
White Female	5.2	5.5	5.2	5.1	5.0	5.1	4.9
Black Male	6.2	5.5	5.5	5.8	5.6	6.0	5.6
Black Female	6.5	5.8	6.1	6.1	5.6	5.9	6.7
White	5.2	5.4	5.2	5.1	5.0	5.2	5.1
Black	6.4	5.7	5.8	6.0	5.6	6.0	6.2
Male	5.5	5.3	5.3	5.2	5.1	5.5	5.4
Female	5.6	5.6	5.4	5.4	5.2	5.4	5.5
Total	5.6	5.5	5.4	5.3	5.2	5.4	5.5

Tables 6.13 – 6.15. list the number of outpatient visits for DOH, stroke, and HTN, as well as the percentage of all outpatient visits that are comprised by each of these conditions in the Tennessee population, according to event-level HDDS outpatient data. For DOH, the total annual number of outpatient visits increased by 80% from 28,718 to 51,765 from 1997 to 2002 (see Figure 6.7). The number of outpatient visits for DOH increased by 89% for Whites compared to 42% for Blacks, while the increase was similar for males and females. During this time period, DOH consistently accounted for around 1.8% of all outpatient visits. The percentage of DOH outpatient visits tended to be slightly higher for males compared to females, and slightly higher for Whites compared to Blacks (See Table 6.13).

Table 6.13. Outpatient Hospital Visits with Primary Diagnosis of Diseases of the Heart, 1997-2002, Tennessee, HDDS Outpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Diseases of the Heart: Number of Visits						
White Male	12,440	16,037	16,470	21,218	21,944	24,291
White Female	10,408	13,161	13,634	17,420	17,646	18,968
Black Male	1,995	2,529	2,119	2,385	2,244	2,797
Black Female	2,230	2,869	2,461	2,764	2,736	3,144
Total White	22,849	29,204	30,108	38,640	39,590	43,259
Total Black	4,225	5,398	4,581	5,150	4,980	5,941
Total Male	15,330	19,601	19,552	25,346	26,170	28,654
Total Female	13,386	16,857	16,866	21,487	21,739	23,111
Total	28,718	36,464	36,424	46,836	47,909	51,765
Diseases Of The Heart: Percentage of Visits						
White Male	2.4%	2.3%	2.3%	2.5%	2.4%	2.5%
White Female	1.6%	1.5%	1.5%	1.6%	1.5%	1.5%
Black Male	1.4%	1.4%	1.3%	1.4%	1.2%	1.3%
Black Female	1.2%	1.2%	1.1%	1.2%	1.0%	1.0%
Total White	2.0%	1.9%	1.9%	2.0%	1.9%	1.9%
Total Black	1.3%	1.3%	1.2%	1.3%	1.1%	1.1%
Total Male	2.2%	2.1%	2.1%	2.3%	2.2%	2.3%
Total Female	1.5%	1.4%	1.4%	1.6%	1.4%	1.4%
Total	1.8%	1.7%	1.7%	1.9%	1.8%	1.8%

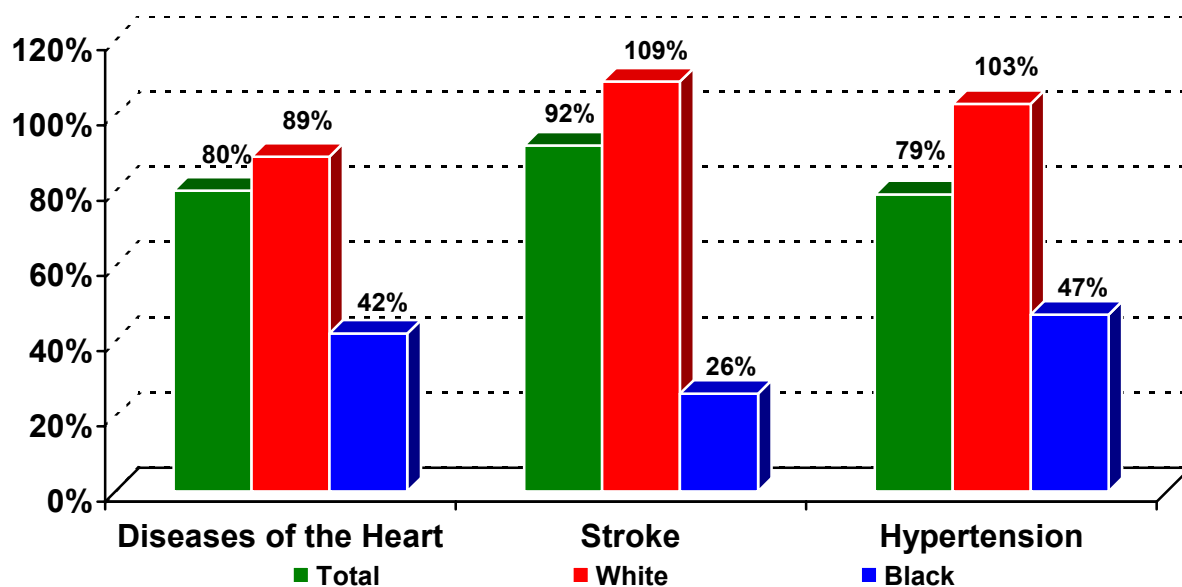


Figure 6.7. Percentage Change in Number of Outpatient Visits, Primary Diagnoses of Diseases of the Heart, Stroke & Hypertension 2002, Tennessee, HDDS Outpatient Files

For stroke, the total annual number of outpatient visits increased by 92% from 3,377 to 6,487 from 1997 to 2002 (See Figure 6.7). The number of outpatient visits for stroke increased by 109% for Whites compared to 26% for Blacks, while the increase was similar for males and females. During this time period, stroke consistently accounted for around 0.2% of all outpatient visits (See Table 6.14).

Table 6.14. Outpatient Hospital Visits with Primary Diagnosis of Stroke, 1997-2002, Tennessee, HDDS Outpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Total Stroke: Number of Visits						
White Male	1,177	1,703	1,721	2,257	2,421	2,387
White Female	1,440	2,092	2,167	2,859	2,934	3,091
Black Male	227	283	223	248	266	285
Black Female	348	372	313	328	351	437
Total White	2,617	3,795	3,888	5,116	5,355	5,478
Total Black	575	655	536	576	617	722
Total Male	1,476	2,070	2,042	2,687	2,883	2,812
Total Female	1,901	2,560	2,608	3,403	3,538	3,675
Total	3,377	4,630	4,650	6,090	6,421	6,487
Total Stroke: Percentage of Visits						
White Male	0.2%	0.2%	0.2%	0.3%	0.3%	0.2%
White Female	0.2%	0.2%	0.2%	0.3%	0.3%	0.2%
Black Male	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%
Black Female	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%
Total White	0.2%	0.2%	0.2%	0.3%	0.3%	0.2%
Total Black	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%
Total Male	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Total Female	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Total	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%

For HTN, the total annual number of outpatient visits increased by 79% from 8,631 to 15,407 from 1997 to 2002 (See Figure 6.7). The number of outpatient visits for HTN increased by 103% for Whites compared to 47% for Blacks, while the increase was similar for males and females. During this time period, HTN consistently accounted for around 0.5% of all outpatient visits. The percentage of HTN outpatient visits tended to be slightly higher for Blacks compared to Whites (See Table 6.15).

Table 6.15. Outpatient Hospital Visits with Primary Diagnosis of Hypertension, 1997-2002, Tennessee, HDDS Outpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Hypertension: Number of Visits						
White Male	2,045	2,748	2,728	3,579	3,788	4,033
White Female	2,934	4,026	3,970	5,163	5,678	6,085
Black Male	1,147	1,530	1,400	1,604	1,726	1,802
Black Female	2,022	2,420	2,274	2,426	2,524	2,856
Total White	4,979	6,774	6,698	8,742	9,466	10,118
Total Black	3,169	3,950	3,675	4,030	4,250	4,658
Total Male	3,400	4,503	4,385	5,537	5,888	6,103
Total Female	5,231	6,753	6,582	8,117	8,761	9,304
Total	8,631	11,256	10,968	13,655	14,649	15,407
Hypertension: Percentage of Visits						
White Male	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
White Female	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Black Male	0.8%	0.8%	0.9%	0.9%	0.9%	0.8%
Black Female	1.1%	1.0%	1.1%	1.0%	1.0%	0.9%
Total White	0.4%	0.4%	0.4%	0.5%	0.5%	0.5%
Total Black	1.0%	0.9%	1.0%	1.0%	0.9%	0.9%
Total Male	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Total Female	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%
Total	0.5%	0.5%	0.5%	0.6%	0.5%	0.5%

Tables 6.16 – 6.18 give the number of outpatient visits for DOH, stroke, and HTN, as well as the percentage of all outpatient visits that are comprised by each of these conditions in the Tennessee population age 65 and over, according to event-level CMS outpatient data. For DOH, the total annual number of outpatient visits for the elderly increased by 15% from 169,622 to 202,572 from 1996 to 2002 (see Figure 6.8). (Note: The number of outpatient visits in the CMS data is greater than the HDDS outpatient data because not all facilities report to HDDS [e.g., VA facilities], while they all bill to CMS). The number of outpatient visits for DOH increased by 16% for elderly Whites compared to 10% for elderly Blacks, and 22% for elderly females compared to 10% for elderly males. During this time period, DOH accounted for around 7-8% of all outpatient visits among those age 65 and over. The percentage of DOH outpatient visits for age 65 and over tended to be slightly higher for males compared to females, and slightly higher for Whites compared to Blacks (See Table 6.16).

Table 6.16. Outpatient Hospital Visits with Primary Diagnosis of Diseases of the Heart 1996-2002, Tennessee, CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Diseases of the Heart: Number of Visits							
White Male	65,830	84,724	84,714	85,954	85,494	85,864	85,518
White Female	86,734	114,491	105,308	102,644	101,189	101,338	98,632
Black Male	5,215	6,441	6,422	6,015	6,027	5,977	6,192
Black Female	9,155	10,877	10,297	10,114	10,246	9,912	9,818
White	152,564	199,215	190,022	188,598	186,683	187,202	184,150
Black	14,370	17,318	16,719	16,129	16,273	15,889	16,010
Male	72,097	92,034	92,127	93,083	92,680	92,933	92,748
Female	97,525	126,941	117,083	114,268	112,975	112,714	109,821
Total	169,622	218,975	209,210	207,351	205,656	205,647	202,572

Table 6.16. Continued

GROUP	1996	1997	1998	1999	2000	2001	2002
Diseases of the Heart: Number of Visits							
White Male	8.7%	10.3%	10.5%	10.5%	10.0%	9.7%	9.2%
White Female	6.9%	8.3%	7.8%	7.6%	7.1%	6.9%	6.4%
Black Male	5.0%	6.0%	6.2%	5.7%	5.4%	5.1%	4.9%
Black Female	5.2%	5.8%	5.6%	5.3%	5.1%	4.8%	4.4%
White	7.6%	9.0%	8.8%	8.7%	8.2%	7.9%	7.5%
Black	5.1%	5.9%	5.8%	5.5%	5.2%	4.9%	4.5%
Male	8.2%	9.8%	9.9%	9.9%	9.4%	9.1%	8.7%
Female	6.7%	8.0%	7.5%	7.3%	6.8%	6.6%	6.1%
Total	7.2%	8.6%	8.4%	8.3%	7.8%	7.5%	7.1%

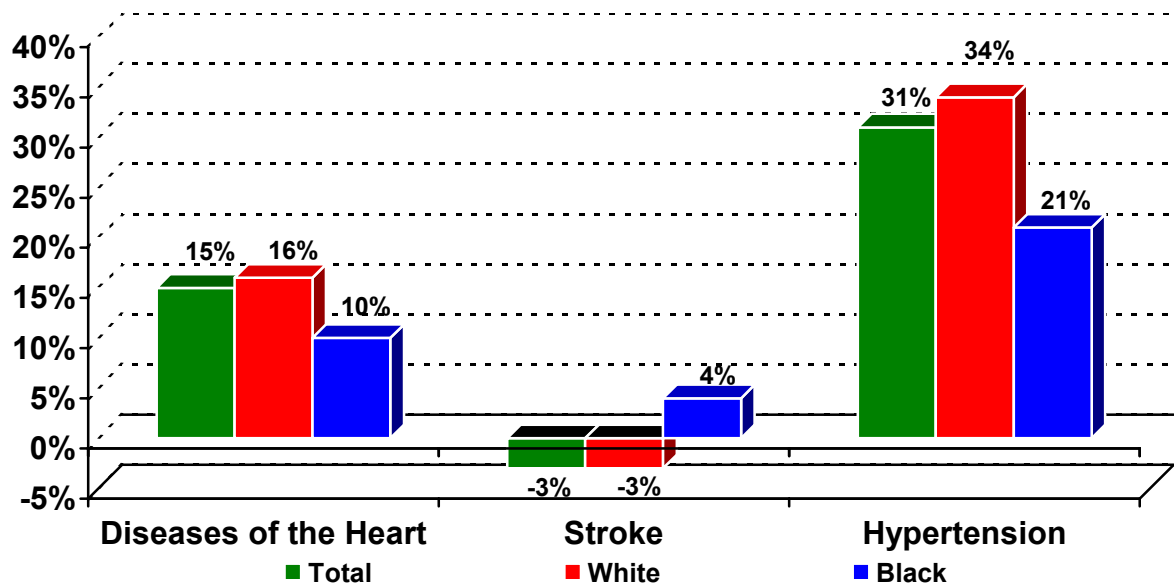


Figure 6.8. Percentage Change in Number of Outpatient Visits, Primary Diagnoses of Diseases of the Heart, Stroke & Hypertension, 2002, Tennessee, CMS Outpatient Files

For stroke, the total annual number of outpatient visits for those age 65 and over decreased by 3% from 54,801 to 52,838 from 1996 to 2002 (see Figure 6.8). The number of outpatient visits for stroke among the elderly increased by 4% for Blacks compared to a 3% decrease for Whites. During this time period, stroke consistently accounted for around 2% of all outpatient visits in the age 65 and over population, with little difference by race or gender (See Table 6.17).

Table 6.17. Outpatient Hospital Visits with Primary Diagnosis of Stroke, 1997-2002, Tennessee, CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Stroke: Number of Visits							
White Male	19,426	24,898	21,482	18,746	19,115	19,035	19,020
White Female	29,122	35,913	31,335	27,746	29,325	29,004	27,452
Black Male	1,906	2,264	1,922	1,766	1,842	2,122	1,996
Black Female	3,590	4,149	3,416	3,352	3,748	4,030	3,761
White	48,548	60,811	52,817	46,492	48,440	48,039	46,472
Black	5,496	6,413	5,338	5,118	5,590	6,152	5,757
Male	21,658	27,381	23,604	20,775	21,324	21,440	21,285
Female	33,143	40,523	35,349	31,565	33,448	33,390	31,553
Total	54,801	67,904	58,953	52,340	54,773	54,832	52,838

Table 6.17. Continued

Group	1996	1997	1998	1999	2000	2001	2002
Stroke: Percentage of Visits							
White Male	2.6%	3.0%	2.7%	2.3%	2.2%	2.2%	2.0%
White Female	2.3%	2.6%	2.3%	2.1%	2.1%	2.0%	1.8%
Black Male	1.8%	2.1%	1.8%	1.7%	1.6%	1.8%	1.6%
Black Female	2.0%	2.2%	1.9%	1.8%	1.9%	1.9%	1.7%
White	2.4%	2.8%	2.5%	2.1%	2.1%	2.0%	1.9%
Black	2.0%	2.2%	1.9%	1.7%	1.8%	1.9%	1.6%
Male	2.5%	2.9%	2.5%	2.2%	2.2%	2.1%	2.0%
Female	2.3%	2.5%	2.3%	2.0%	2.0%	2.0%	1.8%
Total	2.3%	2.7%	2.4%	2.1%	2.1%	2.0%	1.8%

For HTN, the total annual number of outpatient visits for the elderly increased by 31% from 91,280 to 125,636 from 1996 to 2002 (See Figure 6.8). The number of outpatient visits for HTN for those age 65 and over increased by 34% for Whites compared to 21% for Blacks, and 40% for elderly males compared to 28% for elderly females. During this time period, HTN consistently accounted for around 4% of all outpatient visits in the age 65 and over population. The percentage of HTN outpatient visits tended to be slightly higher for elderly Blacks compared to elderly Whites (See Table 6.18).

Table 6.18. Outpatient Hospital Visits with Primary Diagnosis of Hypertension, 1996-2002, Tennessee, CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Hypertension: Number of Visits							
White Male	22,421	26,974	25,837	26,752	28,363	31,130	33,691
White Female	47,603	58,744	54,582	54,094	57,378	61,505	65,774
Black Male	5,955	6,542	6,852	6,401	6,845	6,558	7,813
Black Female	13,685	15,556	15,568	14,907	15,560	14,433	16,356
White	70,024	85,718	80,419	80,846	85,741	92,635	99,465
Black	19,640	22,098	22,420	21,308	22,405	20,991	24,169
Male	28,911	33,964	33,134	33,662	35,815	38,282	42,188
Female	62,369	75,318	71,212	70,261	74,226	77,080	83,448
Total	91,280	109,282	104,346	103,923	110,043	115,364	125,636
Hypertension: Percentage of Visits							
White Male	3.0%	3.3%	3.2%	3.3%	3.3%	3.5%	3.6%
White Female	3.8%	4.3%	4.1%	4.0%	4.0%	4.2%	4.3%
Black Male	5.8%	6.1%	6.6%	6.1%	6.1%	5.6%	6.1%
Black Female	7.8%	8.3%	8.5%	7.9%	7.7%	7.0%	7.3%
White	3.5%	3.9%	3.7%	3.7%	3.8%	3.9%	4.0%
Black	7.0%	7.5%	7.8%	7.2%	7.2%	6.5%	6.9%
Male	3.3%	3.6%	3.6%	3.6%	3.6%	3.8%	3.9%
Female	4.3%	4.7%	4.6%	4.5%	4.5%	4.5%	4.7%
Total	3.9%	4.3%	4.2%	4.1%	4.2%	4.2%	4.4%

Tables 6.19 - 6.24 report the percentage of inpatient hospitalizations for each condition that were admitted through the emergency room (ER) and the percentage of outpatient visits for each condition that were ER visits, based on HDDS and CMS data at the event-level (See Figure 6.9). For DOH, according to HDDS inpatient data for all ages, in 2002 57.2% of inpatient hospitalizations were admitted through the ER, which represented a slight increase from 56.3% in 1997. According to CMS inpatient data for age 65 and over, in 2002 51.4% of inpatient hospitalizations for DOH were admitted through the ER, which represented a slight decline from 54.4% in 1997. In both inpatient files, the percentage of ER admissions for DOH tended to be higher for females compared to males, and higher for Blacks compared to Whites. However, in the CMS inpatient data, while the percentage of ER admissions for DOH declined slightly for Whites from 1997 to 2002, it increased slightly for Blacks (See Table 6.19).

Table 6.19. Percentage of Inpatient Admissions through Emergency Room with Primary Diagnosis of Diseases of the Heart, 1996/7-2002, Tennessee HDDS & CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
HDDS All Ages							
White Male		50.9%	51.4%	49.6%	49.5%	52.7%	52.8%
White Female		56.7%	56.7%	55.1%	54.9%	57.9%	57.4%
Black Male		70.6%	69.9%	69.5%	73.4%	74.6%	73.5%
Black Female		72.8%	72.1%	72.6%	73.0%	75.9%	74.6%
Total White		53.6%	53.9%	52.2%	52.1%	55.2%	55.0%
Total Black		71.8%	71.1%	71.3%	73.2%	75.3%	74.1%
Total Male		53.4%	53.6%	51.4%	51.9%	54.3%	54.8%
Total Female		59.4%	59.1%	57.6%	57.4%	60.0%	59.8%
Total		56.3%	56.2%	54.4%	54.6%	57.1%	57.2%
CMS 65+ Years of Age							
White Male	51.2%	50.1%	50.5%	49.5%	48.7%	47.0%	46.1%
White Female	54.3%	53.9%	54.7%	53.8%	53.3%	51.7%	51.2%
Black Male	65.5%	66.1%	65.4%	64.6%	67.6%	67.9%	68.4%
Black Female	66.0%	67.2%	65.8%	66.6%	67.3%	70.6%	69.1%
Total White	52.8%	52.1%	52.7%	51.8%	51.1%	49.5%	48.8%
Total Black	65.8%	66.8%	65.6%	65.9%	67.5%	69.6%	68.8%
Total Female	55.9%	55.5%	56.3%	55.7%	55.2%	54.3%	53.8%
Total Male	52.6%	51.5%	52.0%	51.0%	50.6%	49.1%	48.6%
Total	54.4%	53.7%	54.3%	53.5%	53.0%	51.9%	51.4%

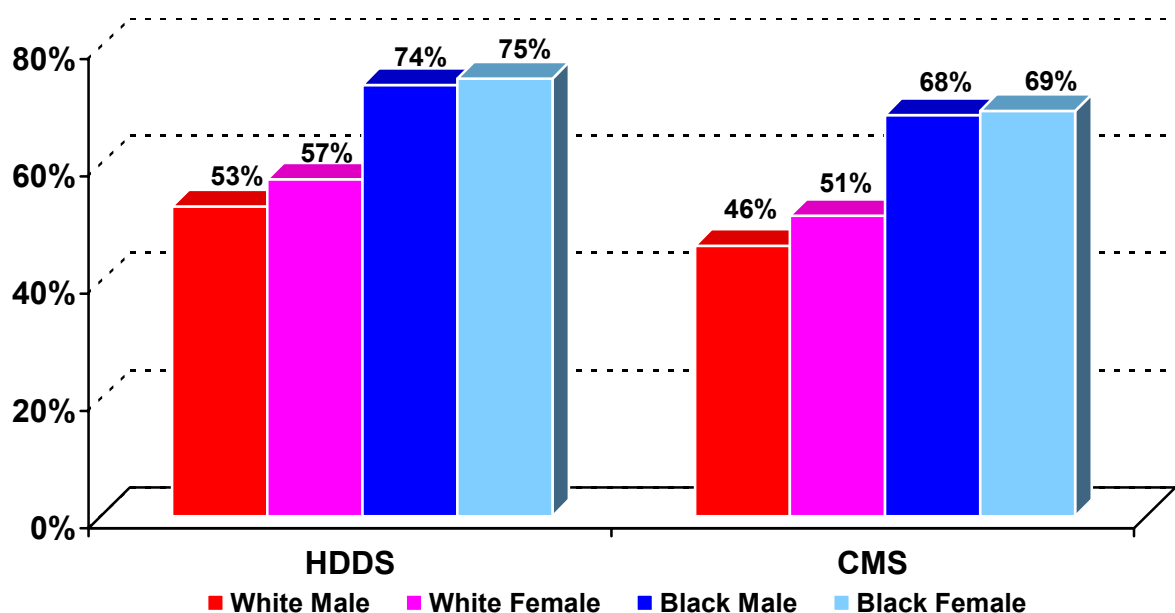


Figure 6.9. Percentage of Inpatient Admissions through Emergency Room with Primary Diagnosis of Diseases of the Heart, 2002, Tennessee, HDDS & CMS Inpatient Files

For stroke, according to HDDS inpatient data for all ages, in 2002 62.6% of inpatient hospitalizations were admitted through the ER, which remained stable since 1997 (See Figure 6.10). According to CMS inpatient data for age 65 and over, in 2002 56.1% of inpatient hospitalizations for stroke were admitted through the ER, which represented an increase from 50.4% in 1997. In both inpatient files, the percentage of ER admissions for stroke tended to be higher for females compared to males, and higher for Blacks compared to Whites. However, in the HDDS inpatient data, the percentage of ER admissions for stroke declined slightly for Blacks from 1997 to 2002 (See Table 6.20).

Table 6.20. Inpatient Emergency Room Utilization with Primary Diagnosis of Stroke, 1996/7-2002, Tennessee HDDS & CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
HDDS All Ages							
White Male		57.1%	56.3%	55.0%	55.5%	57.8%	56.9%
White Female		61.3%	60.5%	61.0%	61.8%	63.8%	63.3%
Black Male		78.7%	75.3%	73.0%	76.2%	75.1%	73.0%
Black Female		79.7%	74.8%	74.3%	74.0%	74.3%	74.8%
Total White		59.5%	58.7%	58.4%	59.0%	61.1%	60.6%
Total Black		79.3%	75.0%	73.8%	74.9%	74.7%	74.1%
Total Male		59.7%	59.7%	57.4%	58.1%	60.0%	59.2%
Total Female		64.0%	63.4%	62.9%	63.6%	65.4%	65.2%
Total		62.1%	61.8%	60.5%	61.2%	63.0%	62.6%
CMS 65+ Years of Age							
White Male	47.4%	45.0%	49.7%	49.6%	50.1%	49.9%	50.2%
White Female	50.5%	51.2%	54.0%	55.7%	56.0%	56.0%	56.7%
Black Male	58.5%	56.8%	60.0%	59.8%	63.1%	61.9%	66.6%
Black Female	58.8%	58.0%	60.6%	61.3%	63.5%	62.3%	68.6%
Total White	49.2%	48.6%	52.2%	53.2%	53.6%	53.4%	54.1%
Total Black	58.7%	57.6%	60.4%	60.8%	63.3%	62.2%	67.8%
Total Male	48.7%	46.2%	51.1%	50.8%	51.8%	51.4%	52.5%
Total Female	51.7%	52.1%	54.9%	56.5%	57.2%	57.0%	58.6%
Total	50.4%	49.7%	53.3%	54.2%	55.0%	54.7%	56.1%

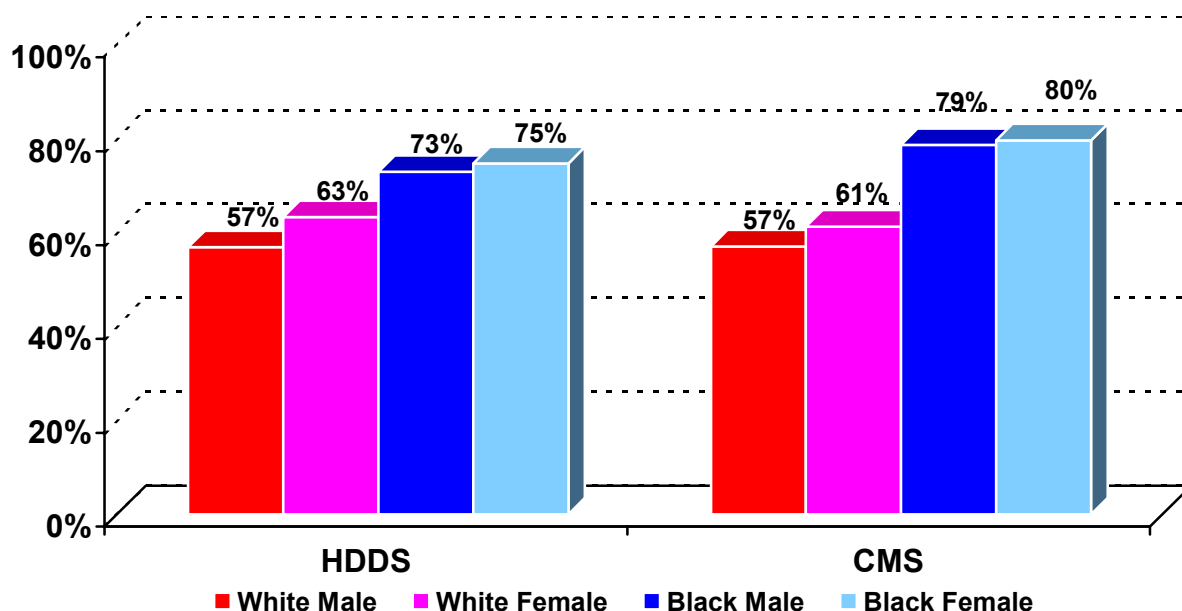


Figure 6.10. Percentage of Inpatient Admissions through Emergency Room with Primary Diagnosis of Stroke, 2002, Tennessee, HDDS & CMS Inpatient Files

For HTN, according to HDDS inpatient data for all ages, in 2002 63.2% of inpatient hospitalizations were admitted through the ER, which represented a slight increase from 59.1% in 1997 (See Figure 6.11). According to CMS inpatient data for age 65 and over, in 2002 57.1% of inpatient hospitalizations for HTN were admitted through the ER, which remained stable since 1997. In both inpatient files, the percentage of ER admissions for HTN tended to be higher for females compared to males, and higher for Blacks compared to Whites. However, in the CMS inpatient data, while the percentage of ER admissions for DOH declined slightly for Whites from 1997 to 2002, it increased for Blacks (See Table 6.21).

Table 6.21. Inpatient Emergency Room Utilization with Primary Diagnosis of Hypertension, 1996/7-2002, Tennessee, HDDS & CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
HDDS All Ages							
White Male		51.7%	53.3%	54.1%	58.1%	59.6%	55.8%
White Female		55.4%	55.8%	56.5%	57.1%	57.9%	58.5%
Black Male		68.5%	68.6%	66.5%	67.2%	73.2%	74.6%
Black Female		67.3%	69.3%	67.9%	69.4%	73.3%	71.2%
Total White		54.0%	54.8%	55.6%	57.5%	58.5%	57.5%
Total Black		67.8%	69.0%	67.3%	68.4%	73.2%	72.7%
Total Male		58.2%	59.1%	59.1%	60.8%	64.8%	62.9%
Total Female		59.7%	60.6%	60.6%	60.8%	63.3%	63.3%
Total		59.1%	60.0%	60.0%	60.8%	63.8%	63.2%
CMS 65+ Years of Age							
White Male	55.5%	50.3%	51.5%	51.4%	55.3%	53.0%	48.2%
White Female	54.0%	54.4%	54.0%	56.3%	54.2%	54.1%	53.5%
Black Male	59.4%	66.5%	63.7%	64.9%	65.4%	67.5%	67.9%
Black Female	62.4%	64.3%	63.9%	64.9%	65.9%	68.6%	68.3%
Total White	54.5%	52.9%	53.1%	54.7%	54.6%	53.7%	51.8%
Total Black	61.3%	65.1%	63.8%	64.9%	65.7%	68.2%	68.2%
Total Male	56.7%	54.7%	55.2%	56.0%	58.7%	57.8%	55.6%
Total Female	56.7%	56.9%	56.6%	58.9%	57.9%	58.6%	58.0%
Total	56.7%	56.1%	56.1%	57.9%	58.2%	58.3%	57.1%

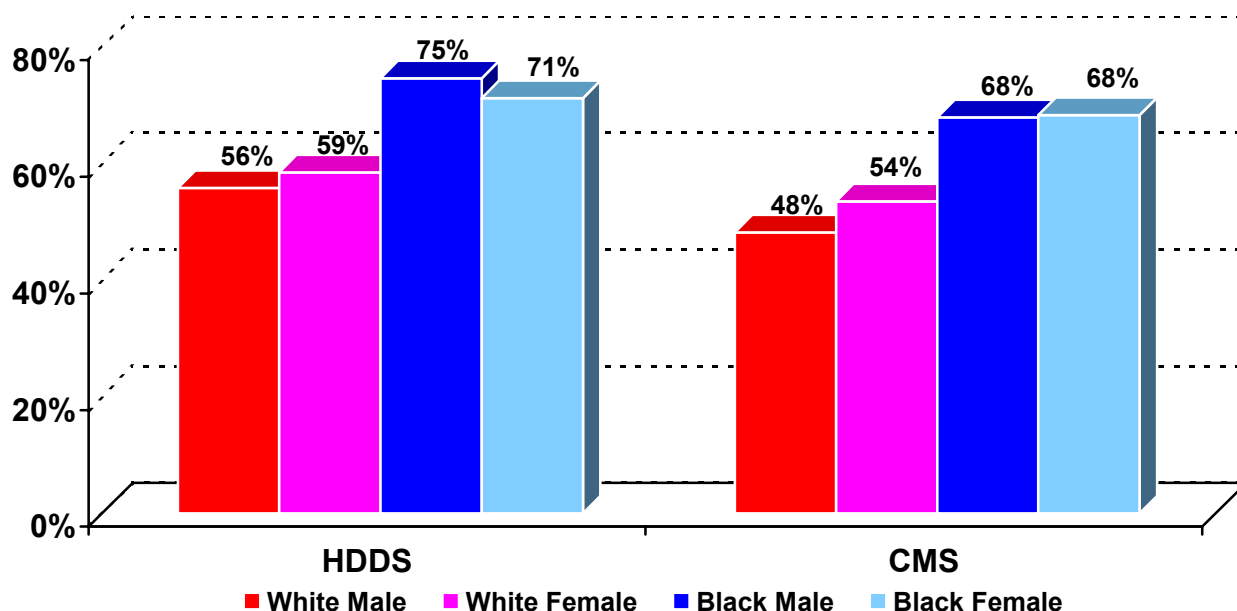


Figure 6.11. Percentage of Inpatient Admissions through Emergency Room with Primary Diagnosis of Hypertension, 2002, Tennessee, HDDS & CMS Inpatient Files

For DOH outpatient visits, according to HDDS outpatient data for all ages, in 2002 48.5% of outpatient visits consisted of visits to the ER, which represented a slight decline from 51.9% in 1997. According to CMS outpatient data for age 65 and over, in 2002 4.7% of outpatient visits for DOH were ER visits, which represented a slight decline from 6.2% in 1997. (Note: The overall number of outpatient visits in the CMS data is greater than the HDDS outpatient data because not all facilities report to HDDS [e.g., VA facilities], while they all bill to CMS. Thus the percentage of ER outpatient visits is also lower.) In the HDDS outpatient file, the percentage of ER outpatient visits for DOH tended to be higher for females compared to males. In both files, the percentage of ER outpatient visits for DOH was higher for Blacks compared to Whites.

Table 6.22. Outpatient Emergency Room Utilization with Primary Diagnosis of Diseases of the Heart, 1996/7-2002, Tennessee, HDDS & CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
HDDS All Ages							
White Male		45.1%	51.5%	46.8%	43.6%	45.4%	44.2%
White Female		53.7%	59.5%	54.2%	52.8%	53.8%	51.7%
Black Male		59.7%	60.9%	56.3%	54.9%	54.8%	54.6%
Black Female		65.1%	67.9%	58.6%	54.8%	57.9%	57.2%
Total White		49.0%	55.1%	50.1%	47.8%	49.1%	47.5%
Total Black		62.6%	64.6%	57.5%	54.9%	56.5%	56.0%
Total Male		47.8%	52.6%	48.0%	44.8%	45.9%	45.2%
Total Female		56.6%	60.9%	55.2%	53.3%	54.5%	52.5%
Total		51.9%	56.4%	51.3%	48.7%	49.8%	48.5%
CMS 65+ Years of Age							
White Male	6.3%	3.0%	3.5%	4.3%	4.3%	4.2%	4.3%
White Female	5.4%	2.6%	3.3%	4.1%	4.5%	4.5%	4.2%
Black Male	10.2%	5.9%	6.6%	7.6%	7.0%	8.0%	11.0%
Black Female	10.3%	4.9%	5.4%	6.9%	6.2%	7.7%	9.3%
Total White	5.8%	2.8%	3.4%	4.2%	4.4%	4.4%	4.3%
Total Black	10.3%	5.3%	5.8%	7.2%	6.5%	7.8%	9.9%
Total Male	6.6%	3.2%	3.8%	4.5%	4.5%	4.5%	4.8%
Total Female	5.9%	2.8%	3.5%	4.4%	4.7%	4.8%	4.7%
Total	6.2%	3.0%	3.6%	4.5%	4.6%	4.7%	4.7%

For stroke outpatient visits, according to HDDS outpatient data for all ages, in 2002 79.4% of outpatient visits consisted of visits to the ER, which represented a slight increase from 76.4% in 1997. According to CMS outpatient data for age 65 and over, in 2002 4.5% of outpatient visits for DOH were ER visits, which remained stable since 1997. There were no clear race or gender differences in ER outpatient visits for stroke in 2002 for either data source. However, in the CMS outpatient data, the percentage of ER outpatient visits for stroke declined for Blacks from 1997 to 2002.

Table 6.23. Outpatient Emergency Room Utilization with Primary Diagnosis of Stroke, 1996/7-2002, Tennessee, HDDS & CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
HDDS All Ages							
White Male		75.0%	78.2%	72.6%	73.5%	77.0%	79.2%
White Female		76.3%	78.4%	73.7%	74.7%	77.5%	78.4%
Black Male		76.2%	71.7%	71.7%	77.8%	77.1%	82.5%
Black Female		75.9%	75.0%	72.2%	69.2%	71.8%	80.1%
Total White		75.7%	78.3%	73.2%	74.2%	77.3%	78.7%
Total Black		76.0%	73.6%	72.0%	72.9%	74.1%	81.0%
Total Male		75.7%	77.3%	72.9%	74.3%	77.7%	80.0%
Total Female		77.0%	78.3%	74.0%	74.3%	77.4%	78.9%
Total		76.4%	77.9%	73.5%	74.3%	77.5%	79.4%
CMS 65+ Years of Age							
White Male	4.8%	2.1%	3.1%	4.2%	4.6%	4.6%	4.3%
White Female	4.7%	2.3%	3.0%	4.5%	4.2%	4.6%	4.6%
Black Male	6.9%	2.7%	3.9%	5.7%	4.5%	5.0%	4.6%
Black Female	6.2%	2.8%	3.4%	4.4%	4.2%	4.7%	4.3%
Total White	4.8%	2.2%	3.1%	4.4%	4.4%	4.6%	4.5%
Total Black	6.5%	2.8%	3.6%	4.8%	4.3%	4.8%	4.4%
Total Male	5.0%	2.2%	3.2%	4.4%	4.6%	4.7%	4.3%
Total Female	5.0%	2.3%	3.1%	4.5%	4.2%	4.6%	4.5%
Total	5.0%	2.3%	3.1%	4.4%	4.4%	4.6%	4.5%

For HTN outpatient visits, according to HDDS outpatient data for all ages, in 2002 76.7% of outpatient visits consisted of visits to the ER, which represented a slight increase from 70.8% in 1997. According to CMS outpatient data for age 65 and over, in 2002 3.3% of outpatient visits for DOH were ER visits, which represented a

slight decline from 7.3% in 1997. In the HDDS outpatient file, the percentage of ER outpatient visits for HTN tended to be higher for females compared to males, and higher for Whites compared to Blacks. However, in the CMS outpatient data, the percentage of ER outpatient visits for DOH was higher for Blacks compared to Whites.

Table 6.24. Outpatient Emergency Room Utilization with Primary Diagnosis of Hypertension, 1996/7-2002, Tennessee, HDDS & CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
HDDS All Ages							
White Male		71.5%	76.3%	73.8%	75.5%	78.9%	77.1%
White Female		72.9%	79.0%	76.0%	78.6%	80.4%	79.4%
Black Male		68.2%	68.6%	61.1%	64.7%	72.2%	69.9%
Black Female		65.5%	69.6%	64.3%	69.6%	72.7%	74.6%
Total White		72.4%	77.9%	75.1%	77.4%	79.8%	78.5%
Total Black		66.5%	69.2%	63.0%	67.6%	72.5%	72.8%
Total Male		70.9%	73.8%	69.9%	72.0%	77.2%	74.9%
Total Female		70.8%	75.7%	72.2%	75.6%	78.4%	78.0%
Total		70.8%	74.9%	71.3%	74.1%	77.9%	76.7%
CMS 65+ Years of Age							
White Male	7.4%	1.7%	1.9%	2.4%	2.4%	2.3%	2.4%
White Female	7.0%	1.8%	2.0%	2.4%	2.8%	2.9%	2.7%
Black Male	7.9%	3.0%	2.7%	3.3%	2.9%	4.3%	6.7%
Black Female	7.7%	2.4%	2.4%	2.9%	2.5%	3.8%	5.7%
Total White	7.1%	1.7%	2.0%	2.4%	2.7%	2.7%	2.6%
Total Black	7.7%	2.6%	2.5%	3.0%	2.6%	4.0%	6.0%
Total Male	7.5%	2.0%	2.0%	2.6%	2.5%	2.7%	3.2%
Total Female	7.2%	1.9%	2.1%	2.6%	2.8%	3.1%	3.3%
Total	7.3%	1.9%	2.1%	2.6%	2.7%	3.0%	3.3%

The CMS carrier file provides a closer approximation to one-year prevalence of physician-diagnosed conditions among the 65 and over population, since it includes bills for physician visits in any setting (i.e., at the physician's office, at a hospital, at an emergency room, at long-term care facilities, or at a patient's home). **Tables 6.25-6.27** report the total and mean number of physician visits for DOH, stroke, and HTN among people age 65 and over at during each year, according to CMS carrier data. **Tables 6.25-6.27** also report the percentage of all physician visits among the age 65 and over population that are comprised by each of these conditions.

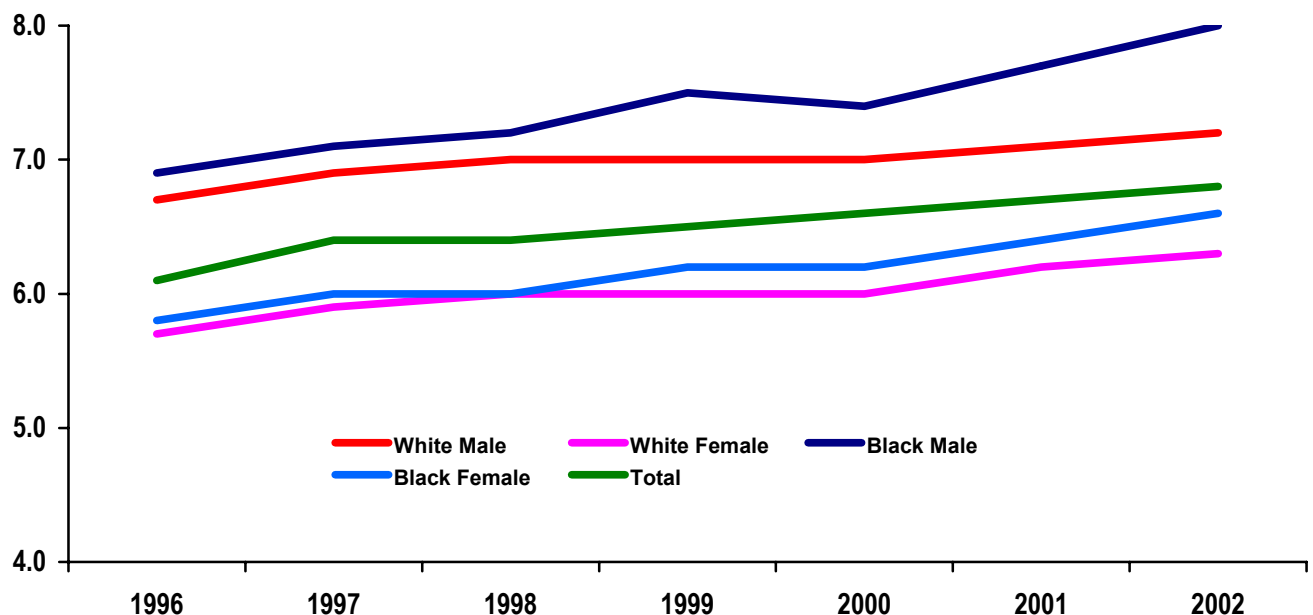
For elderly individuals, the mean number of physician visits for DOH increased by 11% from 6.1 visits in 1996 to 6.8 visits in 2002. The mean number of physician visits for DOH tended to be greater for females compared to males, and greater for Blacks compared to Whites (See Figure 6.12). During this time period, DOH as a primary diagnosis accounted for around 9% of all physician visits. The percentage of DOH physician visits tended to be higher for males compared to females, and higher for Whites compared to Blacks. The total number of physician visits increased by 20% from 1,356,860 in 1996 to 1,627,981 in 2002 (See Table 6.25).

Table 6.25. Physician Visits with Primary Diagnosis of Diseases of the Heart, 1996-2002, Tennessee, CMS Carrier Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Total Number of Visits							
White Male	555,591	612,038	627,299	630,970	642,266	673,830	695,287
White Female	641,769	704,018	701,971	699,491	704,052	740,787	753,577
Black Male	51,038	56,655	57,017	55,695	56,619	59,781	62,230
Black Female	86,084	95,654	92,655	92,775	92,747	94,356	96,607
White	1,197,360	1,316,056	1,329,270	1,330,461	1,346,318	1,414,617	1,448,864
Black	137,122	152,309	149,672	148,470	149,366	154,137	158,837
Male	616,244	676,728	692,845	696,061	708,993	743,461	766,477
Female	740,616	810,764	806,478	804,121	810,060	847,615	861,504
Total	1,356,860	1,487,492	1,499,323	1,500,182	1,519,053	1,591,076	1,627,981

Table 6.25. Continued

GROUP	1996	1997	1998	1999	2000	2001	2002
Mean Number of Visits							
White Male	6.7	6.9	7.0	7.0	7.0	7.1	7.2
White Female	5.7	5.9	6.0	6.0	6.0	6.2	6.3
Black Male	6.9	7.1	7.2	7.5	7.4	7.7	8.0
Black Female	5.8	6.0	6.0	6.2	6.2	6.4	6.6
White	6.1	6.3	6.4	6.5	6.5	6.6	6.7
Black	6.2	6.4	6.4	6.7	6.6	6.9	7.1
Male	6.7	6.9	7.0	7.1	7.1	7.3	7.4
Female	5.7	6.0	6.0	6.1	6.1	6.3	6.4
Total	6.1	6.4	6.4	6.5	6.6	6.7	6.8
Percentage of Visits							
White Male	11.5%	12.0%	11.8%	11.6%	11.4%	11.1%	10.9%
White Female	8.6%	8.9%	8.6%	8.4%	8.2%	8.0%	7.8%
Black Male	8.7%	9.2%	9.0%	8.8%	8.8%	8.4%	8.2%
Black Female	8.4%	8.9%	8.4%	8.3%	8.2%	7.6%	7.3%
White	9.7%	10.1%	9.9%	9.7%	9.5%	9.2%	9.0%
Black	8.5%	9.0%	8.6%	8.5%	8.4%	7.9%	7.6%
Male	11.2%	11.6%	11.5%	11.3%	11.1%	10.7%	10.6%
Female	8.5%	8.9%	8.5%	8.4%	8.2%	7.9%	7.7%
Total	9.6%	10.0%	9.7%	9.5%	9.3%	9.0%	8.8%

**Figure 6.12. Mean Number of Physician Visits, Patients That Have a Primary Diagnosis of Diseases of the Heart, 1996-2002, Tennessee, CMS Carrier Files**

For elderly individuals, the mean number of physician visits for stroke decreased by 7% from 4.5 visits in 1997 to 4.2 visits in 2002. The mean number of physician visits for stroke tended to be greater for females compared to males, and greater for Blacks compared to Whites (See Figure 6.13). During this time period, stroke as a primary diagnosis accounted for 1.7-2.1% of all physician visits, with little variation by race or gender. The total number of physician visits increased by 2.9% (301,338 to 310,171) from 1996 to 2002 (See Table 6.26).

Table 6.26. Physician Visits with Primary Diagnosis of Stroke, 1996-2002, Tennessee, CMS Carrier Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Total: Number of Visits							
White Male	109,689	114,842	106,795	106,464	108,290	113,448	112,496
White Female	152,695	157,257	146,994	146,116	149,021	157,434	158,817
Black Male	12,785	13,340	11,887	11,747	11,270	12,197	12,690
Black Female	21,676	22,758	20,633	20,150	19,428	20,983	22,551
White	262,384	272,099	253,789	252,580	257,590	268,213	271,313
Black	34,461	36,098	32,520	31,897	32,194	33,984	35,241
Male	124,249	129,547	119,739	119,661	121,209	127,264	126,631
Female	177,089	182,402	170,029	168,953	171,398	180,987	183,540
Total	301,338	311,949	289,768	288,614	292,607	308,251	310,171
Mean Number of Visits							
White Male	4.7	4.7	4.5	4.5	4.5	4.5	4.4
White Female	4.2	4.2	4.1	4.1	4.0	4.1	4.0
Black Male	5.2	5.3	5.1	5.4	5.2	5.2	5.4
Black Female	4.9	4.9	4.8	4.7	4.6	4.6	4.9
White	4.4	4.4	4.2	4.2	4.2	4.2	4.1
Black	5.0	5.1	4.9	5.0	5.0	5.0	5.0
Male	4.8	4.8	4.6	4.6	4.6	4.6	4.5
Female	4.3	4.3	4.1	4.1	4.1	4.2	4.1
Total	4.5	4.5	4.3	4.3	4.3	4.3	4.2
Percentage of Visits							
White Male	2.3%	2.2%	2.0%	2.0%	1.9%	1.9%	1.8%
White Female	2.0%	2.0%	1.8%	1.8%	1.7%	1.7%	1.6%
Black Male	2.2%	2.2%	1.9%	1.9%	1.7%	1.7%	1.7%
Black Female	2.1%	2.1%	1.9%	1.8%	1.7%	1.7%	1.7%
White	2.1%	2.1%	1.9%	1.8%	1.8%	1.8%	1.7%
Black	2.1%	2.1%	1.9%	1.8%	1.7%	1.7%	1.7%
Male	2.3%	2.2%	2.0%	1.9%	1.9%	1.8%	1.8%
Female	2.0%	2.0%	1.8%	1.8%	1.7%	1.7%	1.6%
Total	2.1%	2.1%	1.9%	1.8%	1.8%	1.7%	1.7%

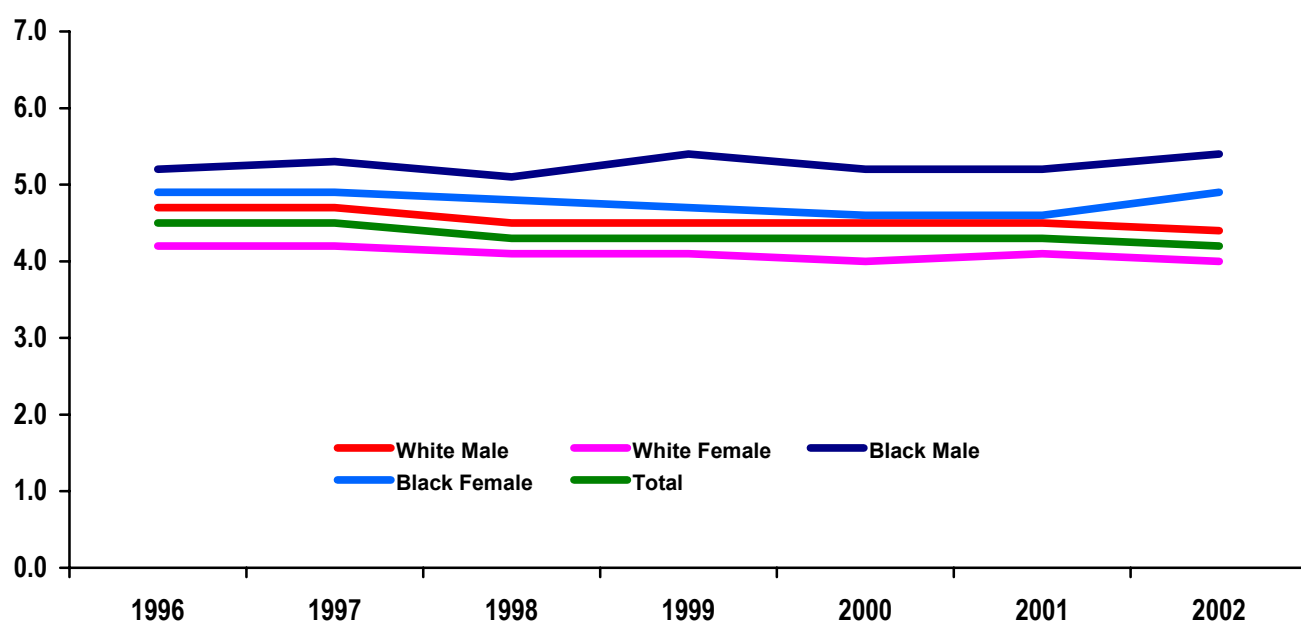


Figure 6.13. Mean Number of Physician Visits, Patients that Have a Primary Diagnosis of Stroke, 1996-2002, Tennessee, CMS Carrier Files

For elderly individuals, the mean number of physician visits for HTN increased by 6% from 3.2 visits in 1997 to 3.4 visits in 2002. The mean number of physician visits for HTN tended to be greater for Blacks compared to Whites, with little difference by gender (See Figure 6.14). During this time period, HTN as a primary diagnosis accounted for roughly 2% of all physician visits, with little variation by race or gender. The total number of visits increased by 38% (740,047 to 1,017,405) between 1996 and 2002 (See Table 6.27).

Table 6.27. Physician Visits with Primary Diagnosis of Hypertension, 1996-2002, Tennessee, CMS Carrier Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Total Number of Visits							
White Male	196,719	211,252	224,859	232,136	247,829	271,737	290,801
White Female	403,250	428,582	445,004	456,220	481,418	525,094	550,716
Black Male	38,608	44,145	45,547	44,551	46,554	49,397	51,457
Black Female	88,153	98,928	99,622	97,560	99,355	103,796	108,910
White	599,969	639,834	669,863	688,356	729,247	796,831	841,517
Black	126,761	143,073	145,169	142,111	145,909	153,193	160,367
Male	239,550	259,062	274,221	281,334	299,732	326,267	347,432
Female	500,497	535,629	553,339	563,472	591,610	639,323	669,973
Total	740,047	794,691	827,560	844,806	891,342	965,590	1,017,405
Mean Number of Visits							
White Male	3.1	3.1	3.2	3.2	3.2	3.2	3.2
White Female	3.1	3.1	3.1	3.1	3.1	3.2	3.3
Black Male	4.3	4.6	4.7	4.5	4.6	4.6	4.7
Black Female	3.8	4.1	4.1	4.0	4.0	4.0	4.1
White	3.1	3.1	3.2	3.1	3.1	3.2	3.2
Black	4.0	4.2	4.2	4.2	4.1	4.2	4.3
Male	3.3	3.3	3.4	3.3	3.4	3.4	3.4
Female	3.2	3.3	3.3	3.3	3.3	3.3	3.4
Total	3.2	3.3	3.3	3.3	3.3	3.4	3.4
Percentage of Visits							
White Male	2.3%	2.2%	2.0%	2.0%	1.9%	1.9%	1.8%
White Female	2.0%	2.0%	1.8%	1.8%	1.7%	1.7%	1.6%
Black Male	2.2%	2.2%	1.9%	1.9%	1.7%	1.7%	1.7%
Black Female	2.1%	2.1%	1.9%	1.8%	1.7%	1.7%	1.7%
White	2.1%	2.1%	1.9%	1.8%	1.8%	1.8%	1.7%
Black	2.1%	2.1%	1.9%	1.8%	1.7%	1.7%	1.7%
Male	2.0%	2.0%	1.8%	1.8%	1.7%	1.7%	1.6%
Female	2.3%	2.2%	2.0%	1.9%	1.9%	1.8%	1.8%
Total	2.1%	2.1%	1.9%	1.8%	1.8%	1.7%	1.7%

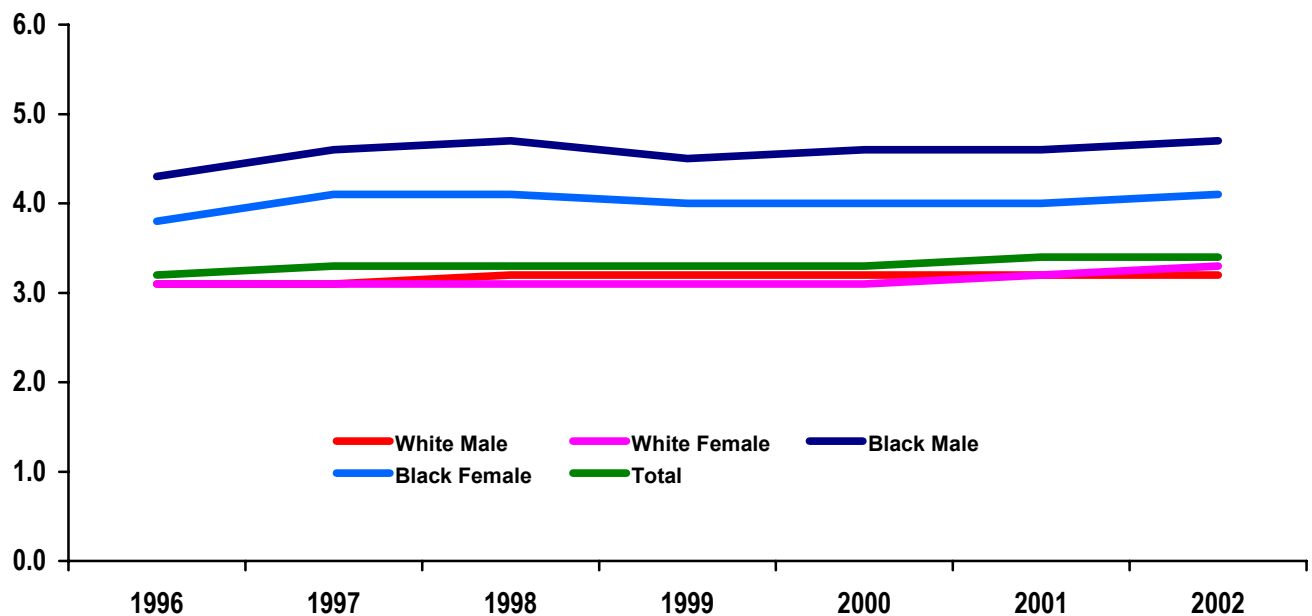


Figure 6.14. Mean Number of Physician Visits, Patients that Have a Primary Diagnosis of Hypertension, 1996-2002, Tennessee, CMS Carrier Files

B. Utilization of Procedures

Table 6.28 reports on trends in utilization of specific inpatient and outpatient procedures for DOH based on event-level HDDS and CMS data. Each table presents the number of procedures performed and the percentage of each procedure among all inpatient hospitalizations or outpatient visits with a primary diagnosis of DOH.

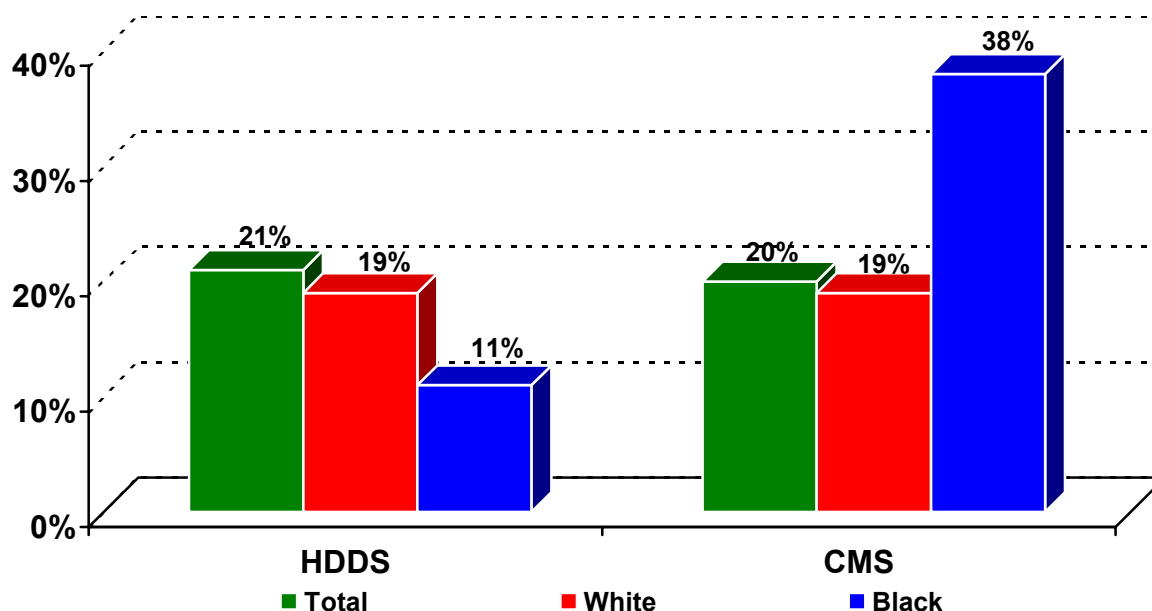
According to HDDS inpatient data, the total number of cardiac and vascular procedures performed each year in an inpatient setting (for all ages) increased by 21% from 33,236 in 1997 to 40,187 in 2002 (See **Table 6.28**). The increase in total number of inpatient procedures for Blacks (11%) was considerably lower than the increase for Whites (19%) (See Figure 6.15). Overall, cardiac and vascular procedures comprised just over half of all inpatient hospital visits (57.7% in 2002). However, this percentage was greater for males compared to females, and greater for Whites compared to Blacks.

Table 6.28. Frequency of Total Cardiac and Vascular Procedures, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Number of Procedures						
White Male	16,954	17,070	18,648	18,544	18,838	19,798
White Female	10,631	10,772	11,611	12,175	12,267	12,964
Black Male	2,226	2,648	1,883	1,952	1,996	2,403
Black Female	2,315	2,521	2,332	2,051	2,140	2,632
Total White	27,590	27,855	30,267	30,720	31,105	32,762
Total Black	4,542	5,176	4,216	4,003	4,136	5,035
Total Male	19,870	21,328	21,928	22,362	23,004	23,702
Total Female	13,360	14,263	14,811	15,357	15,773	16,485
Total	33,236	35,613	36,748	37,720	38,777	40,187

Table 6.28. Continued

GROUP	1997	1998	1999	2000	2001	2002
Percentage of Procedures						
White Male	63.5%	63.4%	65.8%	65.2%	65.6%	66.8%
White Female	45.9%	45.8%	47.8%	48.0%	47.8%	49.0%
Black Male	52.4%	55.4%	51.4%	53.6%	53.7%	57.2%
Black Female	44.9%	45.6%	47.2%	45.4%	46.1%	48.9%
Total White	55.3%	55.2%	57.5%	57.0%	57.2%	58.4%
Total Black	48.3%	50.2%	49.0%	49.1%	49.5%	52.6%
Total Male	61.5%	62.6%	64.6%	64.1%	64.7%	65.8%
Total Female	45.3%	46.3%	48.1%	47.8%	47.8%	49.1%
Total	53.8%	54.8%	56.8%	56.3%	56.5%	57.7%

**Figure 6.15. Percentage Change in Cardiac and Vascular Procedures of Patients Diagnosed with Diseases of the Heart 1996/7-2002, Tennessee, HDDS & CMS Inpatient Files**

According to CMS inpatient data, the total number of cardiac and vascular procedures performed each year in an inpatient setting on patients age 65 and over increased by 20% from 18,157 in 1996 to 21,718 in 2002 (See **Table 6.29**). The increase in total number of inpatient procedures for elderly Blacks (38%) was twice as high as the increase for elderly Whites (19%) (See Figure 6.15). Overall, cardiac and vascular procedures comprised about half of all inpatient hospital visits among those age 65 and over (53.9% in 2002). However, this percentage was greater for males compared to females, with little difference by race.

Table 6.29. Frequency of Total Cardiac and Vascular Procedures, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Number of Procedures							
White Male	8,546	6,089	8,943	9,311	9,658	9,319	10,027
White Female	7,653	5,388	7,822	8,324	8,740	8,568	9,200
Black Male	658	387	693	741	833	771	899
Black Female	1,063	661	1,085	1,301	1,299	1,266	1,476
Total White	16,199	11,477	16,765	17,635	18,398	17,887	19,227
Total Black	1,721	1,048	1,778	2,042	2,132	2,037	2,375
Total Male	9,330	6,529	9,729	10,150	10,539	10,142	10,984
Total Female	8,827	6,111	9,022	9,741	10,109	9,878	10,734
Total	18,157	12,640	18,751	19,891	20,648	20,020	21,718

Table 6.29. Continued

GROUP	1996	1997	1998	1999	2000	2001	2002
Percentage of Procedures							
White Male	54.6%	55.8%	57.2%	59.9%	60.0%	60.8%	62.3%
White Female	40.3%	41.0%	42.3%	45.0%	45.4%	45.8%	47.1%
Black Male	44.7%	45.5%	46.6%	51.4%	54.6%	54.1%	58.4%
Black Female	41.3%	42.0%	41.4%	47.3%	49.1%	49.3%	50.6%
Total White	46.8%	47.7%	49.1%	51.8%	52.0%	52.6%	54.0%
Total Black	42.5%	43.2%	43.3%	48.7%	51.1%	51.0%	53.3%
Total Male	53.8%	55.0%	56.3%	59.2%	59.5%	60.2%	62.0%
Total Female	40.4%	41.0%	42.2%	45.3%	45.7%	46.2%	47.6%
Total	46.3%	47.2%	48.5%	51.5%	51.9%	52.4%	53.9%

According to HDDS inpatient data, the number of cardiac catheterization procedures performed each year in an inpatient setting (for all ages) increased by 4% from 9,787 in 1997 to 10,165 in 2002 (See **Table 6.30.**). The increase in number of cardiac catheterization procedures for Blacks (8%) was considerably higher than the increase for Whites (0.3%) (see Figure 6.16). Overall, cardiac catheterization procedures comprised around 15% of all inpatient hospital visits. This percentage was slightly higher for Blacks compared to Whites by 2002.

Table 6.30. Frequency of Cardiac Catheterization, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Number of Procedures						
White Male	4,684	4,768	4,885	4,635	4,486	4,602
White Female	3,314	3,343	3,339	3,387	3,394	3,417
Black Male	737	874	622	622	684	766
Black Female	765	814	750	686	760	859
Total White	7,999	8,113	8,225	8,022	7,880	8,019
Total Black	1,502	1,689	1,372	1,308	1,444	1,625
Total Male	5,578	6,010	5,816	5,643	5,599	5,649
Total Female	4,208	4,405	4,300	4,333	4,496	4,516
Total	9,787	10,418	10,117	9,976	10,095	10,165
Percentage of Procedures						
White Male	17.5%	17.7%	17.2%	16.3%	15.6%	15.5%
White Female	14.3%	14.2%	13.7%	13.3%	13.2%	12.9%
Black Male	17.3%	18.3%	17.0%	17.1%	18.4%	18.2%
Black Female	14.8%	14.7%	15.2%	15.2%	16.4%	16.0%
Total White	16.0%	16.1%	15.6%	14.9%	14.5%	14.3%
Total Black	16.0%	16.4%	15.9%	16.0%	17.3%	17.0%
Total Male	17.3%	17.6%	17.1%	16.2%	15.7%	15.7%
Total Female	14.3%	14.3%	14.0%	13.5%	13.6%	13.4%
Total	15.8%	16.0%	15.6%	14.9%	14.7%	14.6%

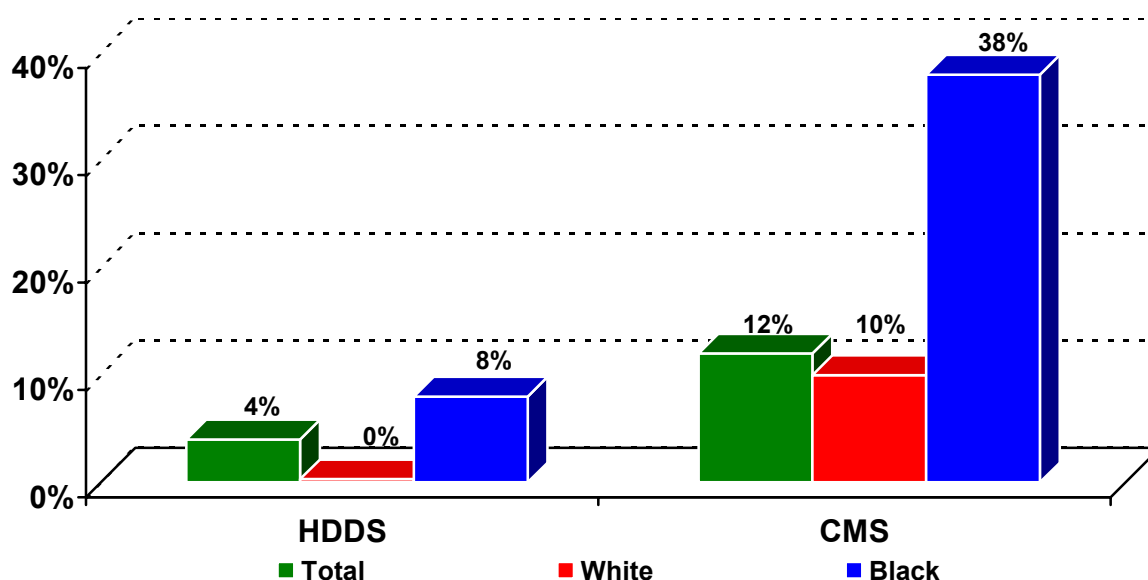


Figure 6.16. Percentage Change in Cardiac Catheterization Procedures of Patients Diagnosed with Diseases of the Heart 1996/7-2002, Tennessee, HDDS & CMS Inpatient Files

According to CMS inpatient data, the number of cardiac catheterization procedures performed each year in an inpatient setting on patients age 65 and over increased by 12% from 10,951 in 1996 to 12,229 in 2002 (See **Table 6.31.**). The increase in number of cardiac catheterization procedures for elderly Blacks (38%) was higher than

Table 6.31. Frequency of Cardiac Catheterization, 1996-2002, Tennessee, CMS Inpatient Files

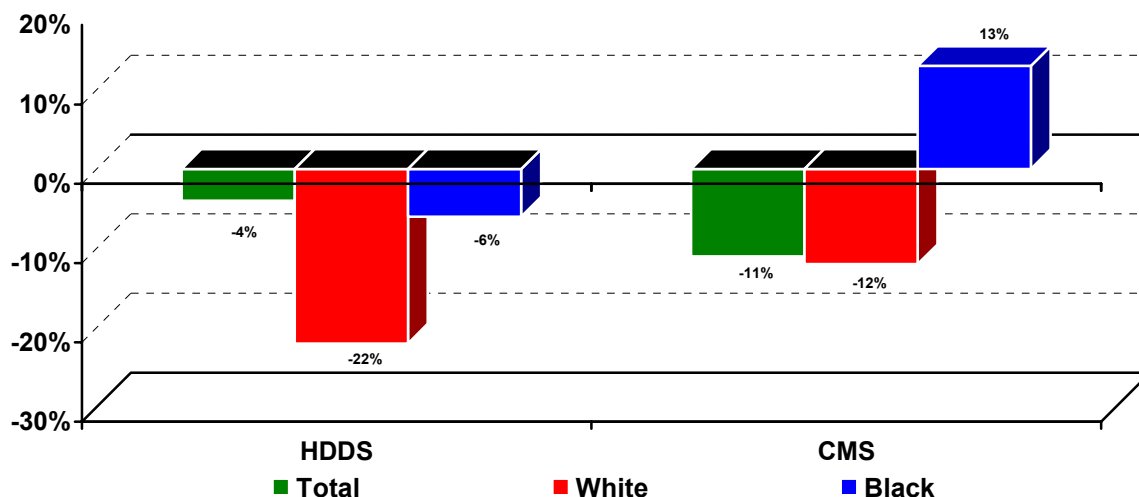
GROUP	1996	1997	1998	1999	2000	2001	2002
Number of Procedures							
White Male	5,406	3,726	3,825	5,676	5,896	5,655	6,016
White Female	4,548	3,096	3,231	4,640	4,844	4,670	4,965
Black Male	341	194	285	378	440	402	473
Black Female	510	332	400	609	609	593	704
Total White	9,954	6,822	7,056	10,316	10,740	10,325	10,981
Total Black	851	526	685	987	1,049	995	1,177
Total Male	5,832	3,956	4,156	6,110	6,364	6,086	6,530
Total Female	5,119	3,464	3,678	5,310	5,489	5,288	5,699
Total	10,951	7,420	7,834	11,420	11,853	11,374	12,229
Percentage of Procedures							
White Male	34.5%	34.1%	24.5%	36.5%	36.6%	36.9%	37.4%
White Female	24.0%	23.6%	17.5%	25.1%	25.1%	25.0%	25.4%
Black Male	23.2%	22.8%	19.2%	26.2%	28.8%	28.2%	30.7%
Black Female	19.8%	21.1%	15.3%	22.2%	23.0%	23.1%	24.2%
Total White	28.7%	28.4%	20.7%	30.3%	30.4%	30.3%	30.8%
Total Black	21.0%	21.7%	16.7%	23.6%	25.1%	24.9%	26.4%
Total Male	33.6%	33.3%	24.1%	35.6%	35.9%	36.1%	36.9%
Total Female	23.4%	23.3%	17.2%	24.7%	24.8%	24.7%	25.3%
Total	27.9%	27.7%	20.3%	29.5%	29.8%	29.8%	30.4%

the increase for elderly Whites (10%) (See Figure 6.16). Overall, cardiac catheterization procedures comprised 30% of all inpatient hospital visits among those age 65 and over in 2002. However, this percentage was greater for males compared to females, and greater for Whites compared to Blacks.

According to HDDS inpatient data, the number of coronary artery bypass graph procedures performed each year in an inpatient setting (for all ages) decreased by 4% from 8,895 in 1997 to 8,550 in 2002 (See **Table 6.32.**). The decrease in coronary artery bypass graph procedures for Blacks (22%) was greater than the decrease for Whites (6%) (See Figure 6.17). Overall, coronary artery bypass graph procedures comprised around 12% of all inpatient hospital visits in 2002. This percentage was greater for males compared to females, and greater for Whites compared to Blacks.

Table 6.32. Frequency of Coronary Artery Bypass Graph, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Number of Procedures						
White Male	5,410	5,240	5,538	5,518	5,270	5,213
White Female	2,360	2,253	2,274	2,369	2,108	2,122
Black Male	457	554	329	317	325	355
Black Female	366	371	305	252	236	287
Total White	7,772	7,496	7,815	7,887	7,378	7,335
Total Black	823	926	635	569	561	642
Total Male	6,082	6,270	6,288	6,416	6,216	6,004
Total Female	2,811	2,839	2,766	2,843	2,580	2,546
Total	8,895	9,115	9,058	9,259	8,796	8,550
Percentage of Procedures						
White Male	20.3%	19.5%	19.6%	19.4%	18.4%	17.6%
White Female	10.2%	9.6%	9.4%	9.3%	8.2%	8.0%
Black Male	10.8%	11.6%	9.0%	8.7%	8.7%	8.5%
Black Female	7.1%	6.7%	6.2%	5.6%	5.1%	5.3%
Total White	15.6%	14.9%	14.8%	14.6%	13.6%	13.1%
Total Black	8.8%	9.0%	7.4%	7.0%	6.7%	6.7%
Total Male	18.8%	18.4%	18.5%	18.4%	17.5%	16.7%
Total Female	9.5%	9.2%	9.0%	8.9%	7.8%	7.6%
Total	14.4%	14.0%	14.0%	13.8%	12.8%	12.3%

**Figure 6.17. Percentage Change in Coronary Artery Bypass Procedures of Patients Diagnosed with Diseases of the Heart 1996/7-2002, Tennessee, HDDS & CMS Inpatient Files**

According to CMS inpatient data, the number of coronary artery bypass graph procedures performed each year in an inpatient setting on patients age 65 and over decreased by 11% from 5,026 in 1996 to 4,454 in 2002 (See **Table 6.33.**). However, while the number of coronary artery bypass graph procedures decreased by 12% for elderly Whites, it actually increased by 13% for elderly Blacks (See Figure 6.17). Overall, coronary artery bypass graph procedures comprised 11% of all inpatient hospital visits among those age 65 and over in 2002. However, this percentage was greater for males compared to females, and greater for Whites compared to Blacks.

Table 6.33. Frequency of Coronary Artery Bypass Graph, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Number of Procedures							
White Male	2,936	2,057	2,828	2,879	2,908	2,646	2,656
White Female	1,750	1,267	1,655	1,650	1,633	1,438	1,464
Black Male	128	72	132	128	158	139	150
Black Female	142	95	145	164	170	149	156
Total White	4,686	3,324	4,483	4,529	4,541	4,084	4,120
Total Black	270	167	277	292	328	288	306
Total Male	3,106	2,153	2,989	3,040	3,077	2,797	2,823
Total Female	1,920	1,374	1,826	1,842	1,817	1,597	1,631
Total	5,026	3,527	4,815	4,882	4,894	4,394	4,454
Percentage of Procedures							
GROUP	1996	1997	1998	1999	2000	2001	2002
White Male	18.7%	18.8%	18.1%	18.5%	18.1%	17.3%	16.5%
White Female	9.2%	9.6%	9.0%	8.9%	8.5%	7.7%	7.5%
Black Male	8.7%	8.5%	8.9%	8.9%	10.3%	9.8%	9.7%
Black Female	5.5%	6.0%	5.5%	6.0%	6.4%	5.8%	5.4%
Total White	13.5%	13.8%	13.1%	13.3%	12.8%	12.0%	11.6%
Total Black	6.7%	6.9%	6.7%	7.0%	7.9%	7.2%	6.9%
Total Male	17.9%	18.1%	17.3%	17.7%	17.4%	16.6%	15.9%
Total Female	8.8%	9.2%	8.5%	8.6%	8.2%	7.5%	7.2%
Total	12.8%	13.2%	12.5%	12.6%	12.3%	11.5%	11.1%

According to HDDS inpatient data, the number of angioplasty and stenting procedures performed each year in an inpatient setting (for all ages) increased by 43% from 8,651 in 1997 to 12,409 in 2002 (See **Table 6.34.**). The increase in angioplasty and stenting procedures did not differ substantially by race or gender. Overall, angioplasty and stenting procedures comprised around 18% of all inpatient hospital visits in 2002 (see Figure 6.18). This percentage was greater for males compared to females, and greater for Whites compared to Blacks.

Table 6.34. Frequency of Angioplasty and Stenting, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Number of Procedures						
White Male	4,984	5,058	6,033	5,900	6,356	6,876
White Female	2,585	2,875	3,132	3,357	3,423	3,755
Black Male	417	601	403	409	415	541
Black Female	377	472	426	365	379	513
Total White	7,570	7,938	9,169	9,258	9,779	10,631
Total Black	795	1,077	829	774	794	1,054
Total Male	5,598	6,132	6,861	6,858	7,442	7,894
Total Female	3,051	3,574	3,752	3,987	4,176	4,515
Total	8,651	9,715	10,617	10,846	11,618	12,409
Percentage of Procedures						
White Male	3.4%	4.4%	5.5%	5.7%	6.4%	6.8%
White Female	1.9%	2.1%	2.5%	2.7%	3.1%	3.6%
Black Male	1.1%	2.0%	2.6%	2.6%	3.6%	4.4%
Black Female	0.4%	1.2%	1.1%	2.4%	2.4%	2.7%
Total White	2.7%	3.3%	4.1%	4.4%	4.9%	5.4%
Total Black	0.7%	1.6%	1.8%	2.5%	2.9%	3.5%
Total Male	3.2%	4.3%	5.2%	5.4%	5.9%	6.4%
Total Female	1.7%	2.0%	2.4%	2.7%	2.9%	3.4%
Total	2.5%	3.2%	3.9%	4.1%	4.5%	5.1%

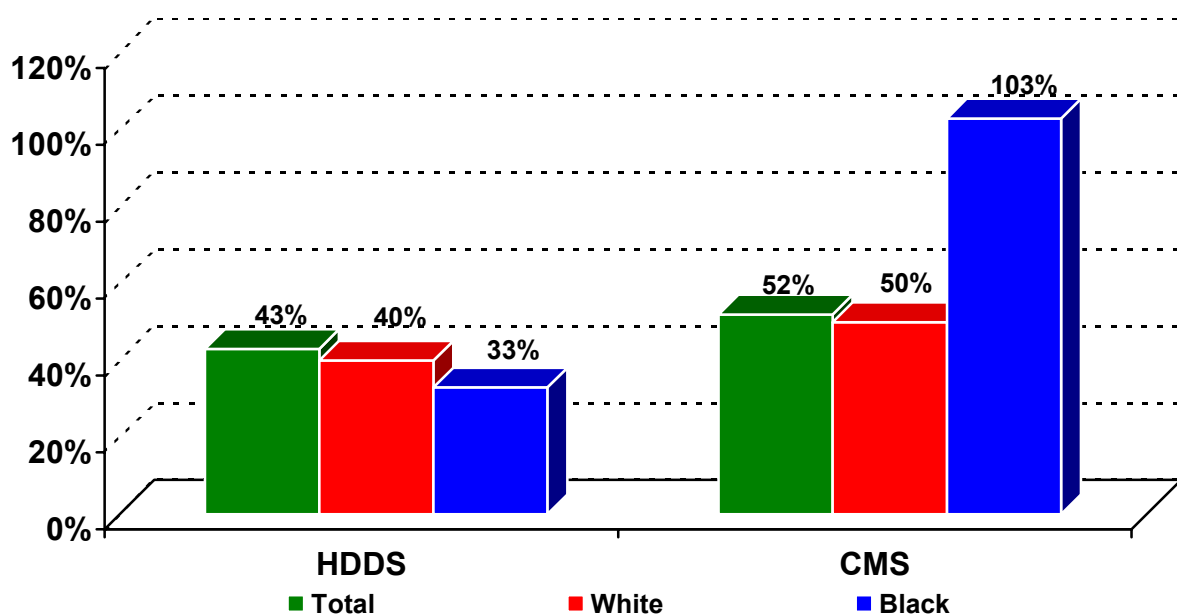


Figure 6.18. Percentage Change in Angioplasty and Stenting Procedures of Patients Diagnosed with Diseases of the Heart 1996/7-2002, Tennessee, HDDS & CMS Inpatient Files

According to CMS inpatient data, the number of angioplasty and stenting procedures performed each year in an inpatient setting on patients age 65 and over increased by 51.8% from 3,947 in 1996 to 5,992 in 2002 (See **Table 6.35.**). The increase in angioplasty and stenting procedures for elderly Blacks (103%) was greater than the increase for elderly Whites (50%) (see Figure 6.18). Overall, angioplasty and stenting procedures comprised 15% of all inpatient hospital visits among those age 65 and over in 2002. However, this percentage was greater for males compared to females, and greater for Whites compared to Blacks.

Table 6.35. Frequency of Angioplasty and Stenting, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Number of Procedures							
White Male	1,988	1,475	2,175	2,655	2,715	2,798	3,059
White Female	1,682	1,255	1,899	2,150	2,257	2,241	2,450
Black Male	87	58	114	148	171	146	177
Black Female	135	108	174	229	224	210	274
Total White	3,670	2,730	4,074	4,805	4,972	5,039	5,509
Total Black	222	166	288	377	395	356	451
Total Male	2,107	1,542	2,301	2,822	2,906	2,959	3,253
Total Female	1,840	1,372	2,100	2,404	2,499	2,460	2,739
Total	3,947	2,914	4,401	5,226	5,405	5,419	5,992
Percentage of Procedures							
GROUP	1996	1997	1998	1999	2000	2001	2002
White Male	12.7%	13.5%	13.9%	17.1%	16.9%	18.2%	19.0%
White Female	8.9%	9.6%	10.3%	11.6%	11.7%	12.0%	12.6%
Black Male	5.9%	6.8%	7.7%	10.3%	11.2%	10.3%	11.5%
Black Female	5.2%	6.9%	6.6%	8.3%	8.5%	8.2%	9.4%
Total White	10.6%	11.3%	11.9%	14.1%	14.1%	14.8%	15.5%
Total Black	5.5%	6.8%	7.0%	9.0%	9.5%	8.9%	10.1%
Total Male	12.1%	13.0%	13.3%	16.5%	16.4%	17.6%	18.4%
Total Female	8.4%	9.2%	9.8%	11.2%	11.3%	11.5%	12.1%
Total	10.1%	10.9%	11.4%	13.5%	13.6%	14.2%	14.9%

According to HDDS inpatient data, the number of open heart surgeries performed each year in an inpatient setting (for all ages) increased by 136% from 362 in 1997 to 854 in 2002 (See **Table 6.36.**). The increase in open heart surgeries for Whites (142%) was greater than the increase for Blacks (70%) (See Figure 6.19). Overall, open

heart surgeries comprised 1.2% of all inpatient hospital visits in 2002. This percentage was slightly higher for Whites compared to Blacks.

Table 6.36. Frequency of Open Heart Surgery, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Number of Procedures						
White Male	166	157	177	257	360	406
White Female	140	125	156	191	282	334
Black Male	20	17	18	26	34	38
Black Female	23	21	33	35	49	35
Total White	306	282	333	448	642	740
Total Black	43	38	51	61	83	73
Total Male	194	226	210	302	429	468
Total Female	168	201	202	251	360	386
Total	362	427	412	553	789	854
Percentage of Procedures						
White Male	0.6%	0.6%	0.6%	0.9%	1.3%	1.4%
White Female	0.6%	0.5%	0.6%	0.8%	1.1%	1.3%
Black Male	0.5%	0.4%	0.5%	0.7%	0.9%	0.9%
Black Female	0.4%	0.4%	0.7%	0.8%	1.1%	0.7%
Total White	0.6%	0.6%	0.6%	0.8%	1.2%	1.3%
Total Black	0.5%	0.4%	0.6%	0.7%	1.0%	0.8%
Total Male	0.6%	0.7%	0.6%	0.9%	1.2%	1.3%
Total Female	0.6%	0.7%	0.7%	0.8%	1.1%	1.1%
Total	0.6%	0.7%	0.6%	0.8%	1.2%	1.2%

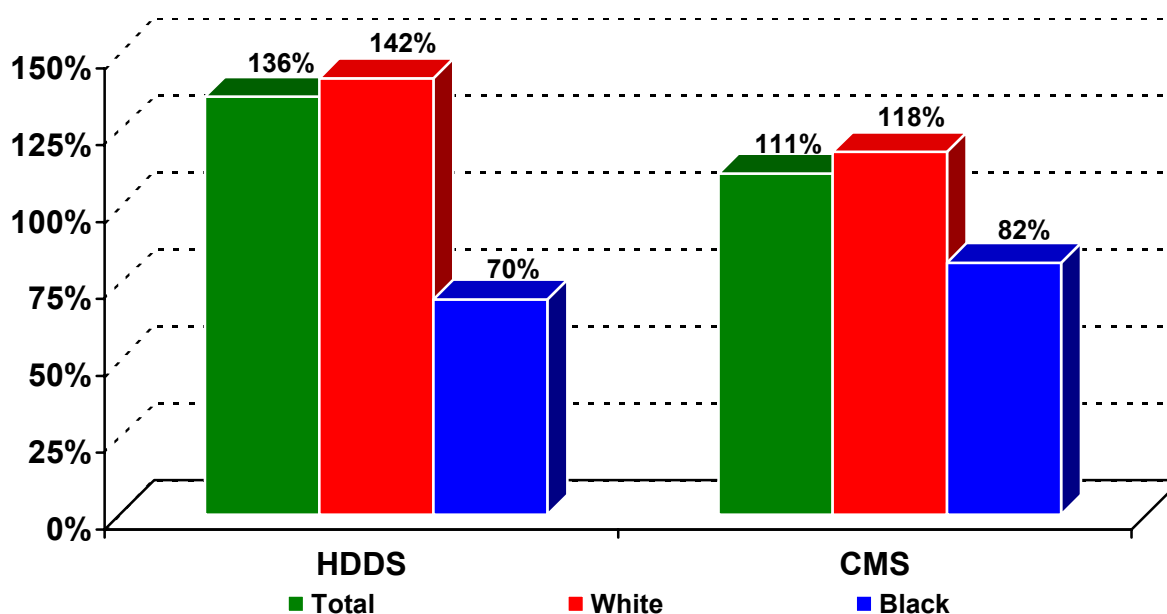


Figure 6.19. Percentage Change in Open Heart Surgical Procedures of Patients Diagnosed with Diseases of the Heart 1996/7-2002, Tennessee, HDDS & CMS Inpatient Files

According to CMS inpatient data, the number of open heart surgeries performed each year in an inpatient setting on patients age 65 and over increased by 111% from 347 in 1996 to 732 in 2002 (See **Table 6.37.**). The increase in open heart surgeries for elderly Whites (118%) was greater than the increase for elderly Blacks (82%) (See Figure 6.19). Overall, open heart surgeries comprised 1.8% of all inpatient hospital visits among those age 65 and over in 2002. However, this percentage was slightly higher for Whites compared to Blacks.

Table 6.37. Frequency of Open Heart Surgery, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Number of Procedures							
White Male	147	128	125	216	237	265	319
White Female	160	151	134	262	277	281	349
Black Male	15	8	9	17	16	29	26
Black Female	18	15	16	35	30	23	34
Total White	307	279	259	478	514	546	668
Total Black	33	23	25	52	46	52	60
Total Male	166	136	135	237	254	295	346
Total Female	181	167	152	302	307	305	386
Total	347	303	287	539	561	600	732
Percentage of Procedures							
White Male	0.9%	1.2%	.8%	1.4%	1.5%	1.7%	2.0%
White Female	0.8%	1.1%	.7%	1.4%	1.4%	1.5%	1.8%
Black Male	1.0%	.9%	.6%	1.2%	1.0%	2.0%	1.7%
Black Female	0.7%	1.0%	.6%	1.3%	1.1%	.9%	1.2%
Total White	.9%	1.2%	.8%	1.4%	1.5%	1.6%	1.9%
Total Black	.8%	.9%	.6%	1.2%	1.1%	1.3%	1.3%
Total Male	1.0%	1.1%	.8%	1.4%	1.4%	1.8%	2.0%
Total Female	.8%	1.1%	.7%	1.4%	1.4%	1.4%	1.7%
Total	0.9%	1.1%	.7%	1.4%	1.4%	1.6%	1.8%

According to HDDS inpatient data, the number of heart valve surgeries performed each year in an inpatient setting (for all ages) increased by 108% from 89 in 1997 to 185 in 2002 (See **Table 6.38.**). The increase in heart valve surgeries for Whites (120%) was greater than the increase for Blacks (8%) (See Figure 6.20). Overall, heart valve surgeries comprised 0.3% of all inpatient hospital visits in 2002.

Table 6.38. Frequency of Heart Valve Surgery, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Number of Procedures						
White Male	34	48	55	85	88	77
White Female	40	32	58	68	66	86
Black Male	6	8	7	7	1	5
Black Female	7	8	4	3	8	9
Total White	74	80	113	153	154	163
Total Black	13	16	11	10	9	14
Total Male	41	63	63	96	100	87
Total Female	48	45	65	82	81	98
Total	89	108	128	178	181	185
Percentage of Procedures						
White Male	0.1%	0.2%	0.2%	0.3%	0.3%	0.3%
White Female	0.2%	0.1%	0.2%	0.3%	0.3%	0.3%
Black Male	0.1%	0.2%	0.2%	0.2%	0.0%	0.1%
Black Female	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%
Total White	0.1%	0.2%	0.2%	0.3%	0.3%	0.3%
Total Black	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%
Total Male	0.1%	0.2%	0.2%	0.3%	0.3%	0.2%
Total Female	0.2%	0.1%	0.2%	0.3%	0.2%	0.3%
Total	0.1%	0.2%	0.2%	0.3%	0.3%	0.3%

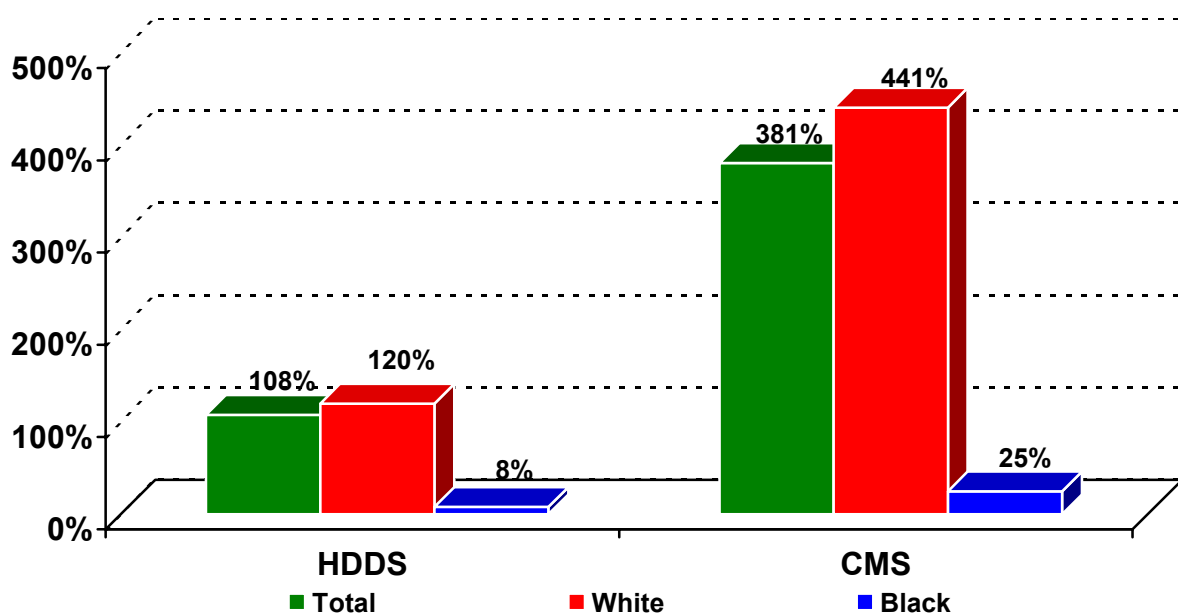


Figure 6.20. Percentage Change in Heart Valve Surgical Procedures of Patients Diagnosed with Diseases of the Heart 1996/7-2002, Tennessee, HDDS & CMS Inpatient Files

According to CMS inpatient data, the number of heart valve surgeries performed each year in an inpatient setting on patients age 65 and over increased by 381% from 27 in 1996 to 130 in 2002 (See **Table 6.39.**). The increase in heart valve surgeries for elderly Whites (441%) was greater than the increase for elderly Blacks (25%). Overall, heart valve surgeries comprised 0.3% of all inpatient hospital visits among those age 65 and over in 2002 (see Figure 6.21).

Table 6.39. Frequency of Heart Valve Surgery, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Number of Procedures							
White Male	10	21	29	25	39	56	46
White Female	13	27	21	39	55	42	79
Black Male	2	2	1	3	4	0	1
Black Female	2	1	2	1	1	2	4
Total White	23	48	50	64	94	98	125
Total Black	4	3	3	4	5	2	5
Total Male	12	23	30	28	43	57	47
Total Female	15	28	23	40	59	44	83
Total	27	51	53	68	102	101	130
Percentage of Procedures							
GROUP	1996	1997	1998	1999	2000	2001	2002
White Male	.1%	.2%	.2%	.2%	.2%	.4%	.3%
White Female	.1%	.2%	.1%	.2%	.3%	.2%	.4%
Black Male	.1%	.2%	.1%	.2%	.3%	.0%	.1%
Black Female	.1%	.1%	.1%	.0%	.0%	.1%	.1%
Total White	.1%	.2%	.1%	.2%	.3%	.3%	.4%
Total Black	.1%	.1%	.1%	.1%	.1%	.1%	.1%
Total Male	.1%	.2%	.2%	.2%	.2%	.3%	.3%
Total Female	.1%	.2%	.1%	.2%	.3%	.2%	.4%
Total	.1%	.2%	.1%	.2%	.3%	.3%	.3%

According to HDDS inpatient data, the number of heart transplants performed each year in an inpatient setting (for all ages) increased by 71% from 21 in 1997 to 36 in 2002 (See **Table 6.40.**). Twice as many heart transplants were performed on men (24) than on women (12) in 2002.

Table 6.40. Frequency of Heart Transplant, 1997-2002, Tennessee, HDDS Inpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Number of Procedures						
White Male	17	13	11	16	20	16
White Female	2	5	5	6	4	10
Black Male	1	2	1	3	1	4
Black Female	1	1	1	1	5	0
Total White	19	18	16	22	24	26
Total Black	2	3	2	4	6	4
Total Male	18	16	14	20	25	24
Total Female	3	6	6	8	9	12
Total	21	22	20	28	34	36
Percentage of Procedures						
White Male	0.1%	0.0%	0.0%	0.1%	0.1%	0.1%
White Female	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Black Male	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%
Black Female	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
Total White	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total Black	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
Total Male	0.1%	0.0%	0.0%	0.1%	0.1%	0.1%
Total Female	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%

According to CMS inpatient data, there were one to three heart transplants performed each year in an inpatient setting on patients age 65 and over during the period 1996 to 2002 (See **Table 6.41.**). (Note: CMS data on heart transplants in 1998 are not reported because there was a systematic coding error for transplants in this year.)

Table 6.41. Frequency of Heart Transplant, 1996-2002, Tennessee, CMS Inpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Number of Procedures							
White Male	1	1	---	2	2	0	1
White Female	0	1	---	1	0	0	0
Black Male	0	0	---	0	0	0	0
Black Female	0	0	---	0	0	0	0
Total White	1	2	---	3	2	0	1
Total Black	0	0	---	0	0	0	0
Total Male	0	1	---	2	0	0	1
Total Female	1	1	---	1	2	0	0
Total	1	2	---	3	2	0	1
Percentage of Procedures							
GROUP	1996	1997	1998	1999	2000	2001	2002
White Male	.0%	.0%	---	.0%	.0%	.0%	.0%
White Female	.0%	.0%	---	.0%	.0%	.0%	.0%
Black Male	.0%	.0%	---	.0%	.0%	.0%	.0%
Black Female	.0%	.0%	---	.0%	.0%	.0%	.0%
Total White	.0%	.0%	---	.0%	.0%	.0%	.0%
Total Black	.0%	.0%	---	.0%	.0%	.0%	.0%
Total Male	.0%	.0%	---	.0%	.0%	.0%	.0%
Total Female	.0%	.0%	---	.0%	.0%	.0%	.0%
Total	.0%	.0%	---	.0%	.0%	.0%	.0%

In terms of outpatient procedures, according to HDDS outpatient data, the number of cardiac catheterization procedures performed each year in an outpatient setting (for all ages) increased by 120% from 7,622 in 1997 to 16,727 in 2002 (See **Table 6.42.**). The increase in number of outpatient cardiac catheterization procedures was slightly lower for Black males (98%) and slightly higher for Black females (159%) compared to the overall increase (See Figure 6.21). Overall, cardiac catheterization procedures comprised around 36% of all outpatient hospital

visits in 2002. This percentage was slightly higher for Whites compared to Blacks, and slightly higher for males compared to females.

Table 6.42. Frequency of Cardiac Catheterization, 1997-2002, Tennessee, HDDS Outpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Number of Procedures						
White Male	4,208	4,678	5,138	7,360	7,622	8,821
White Female	2,399	2,735	3,131	4,405	4,517	5,404
Black Male	363	482	430	566	545	718
Black Female	299	378	420	548	512	775
Total White	6,608	7,415	8,269	11,766	12,139	14,225
Total Black	662	860	850	1,115	1,057	1,493
Total Male	4,792	5,432	5,857	8,517	8,976	10,204
Total Female	2,828	3,281	3,715	5,244	5,390	6,523
Total	7,622	8,715	9,573	13,765	14,366	16,727
Percentage of Procedures						
White Male	37.2%	32.7%	35.0%	39.2%	38.8%	40.9%
White Female	25.7%	23.2%	25.8%	28.7%	28.9%	31.9%
Black Male	20.7%	21.8%	23.6%	27.4%	27.1%	28.7%
Black Female	15.0%	15.1%	19.2%	22.5%	21.2%	27.3%
Total White	32.0%	28.4%	30.8%	34.5%	34.4%	36.9%
Total Black	17.7%	18.2%	21.2%	24.8%	23.9%	28.0%
Total Male	34.5%	31.1%	33.7%	37.9%	38.2%	39.9%
Total Female	23.5%	21.8%	24.7%	27.6%	27.9%	31.4%
Total	29.4%	26.8%	29.5%	33.2%	33.5%	36.1%

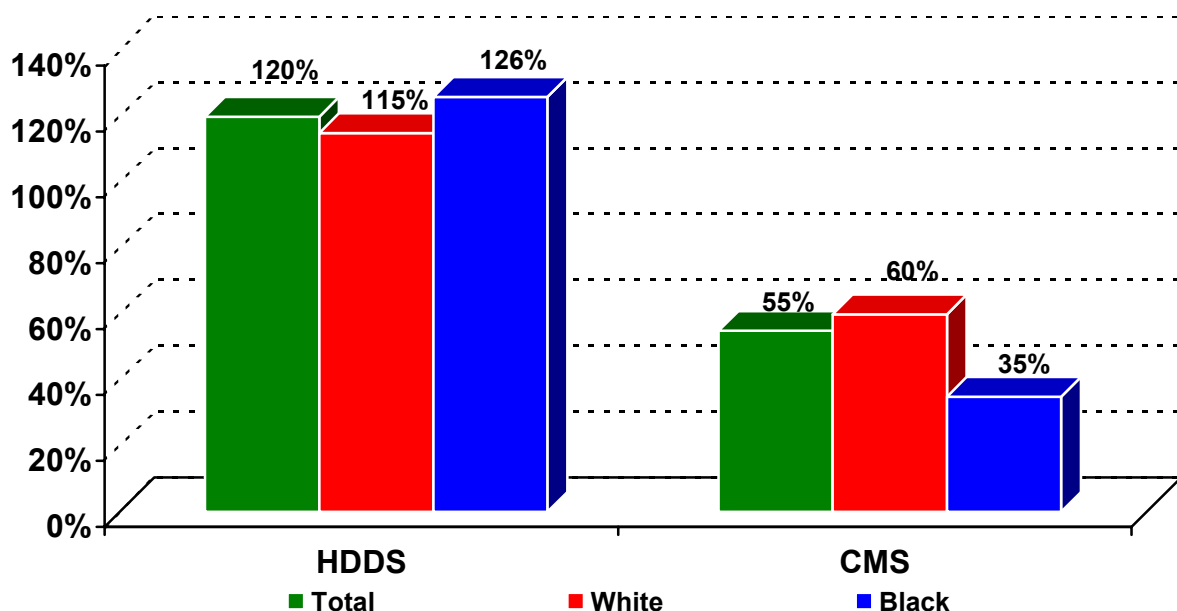


Figure 6.21. Percentage Change in Cardiac Catheterization Procedures of Patients Diagnosed with Diseases of the Heart 1996/7-2002, Tennessee, HDDS & CMS Outpatient Files

According to CMS outpatient data, the number of cardiac catheterization procedures performed each year in an outpatient setting on patients age 65 and over increased by 55% from 591 in 1996 to 917 in 2002 (See **Table 6.43**). The increase in number of outpatient cardiac catheterization procedures for elderly Whites (60%) was higher than the increase for elderly Blacks (35%) (See Figure 6.21). Overall, cardiac catheterization procedures comprised 1.2% of all outpatient hospital visits among those age 65 and over in 2002. However, this percentage was greater for Whites compared to Blacks.

Table 6.43. Frequency of Cardiac Catheterization, 1996-2002, Tennessee, CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Number of Procedures							
White Male	292	273	373	339	371	397	434
White Female	249	453	332	328	364	399	430
Black Male	11	25	24	14	18	17	18
Black Female	26	41	31	22	32	35	32
Total White	541	726	705	667	735	796	864
Total Black	37	66	55	36	50	52	50
Total Male	310	298	400	356	389	415	455
Total Female	281	501	367	353	397	437	462
Total	591	799	767	709	786	852	917
Percentage of Procedures							
White Male	1.2%	1.1%	1.2%	1.2%	1.2%	1.3%	1.4%
White Female	.8%	1.2%	.9%	.9%	1.0%	1.1%	1.2%
Black Male	.6%	1.1%	1.1%	.7%	.8%	.8%	.8%
Black Female	.7%	1.0%	.8%	.5%	.8%	.9%	.8%
Total White	1.0%	1.1%	1.0%	1.0%	1.1%	1.2%	1.3%
Total Black	.7%	1.0%	.9%	.6%	.8%	.8%	.8%
Total Male	1.2%	1.1%	1.2%	1.1%	1.2%	1.3%	1.4%
Total Female	.8%	1.2%	.8%	.8%	.9%	1.0%	1.1%
Total	.9%	1.1%	1.0%	1.0%	1.1%	1.1%	1.2%

In terms of outpatient procedures, according to HDDS outpatient data, the number of angioplasty and stenting procedures performed each year in an outpatient setting (for all ages) increased by 268% from 639 in 1997 to 2,350 in 2002 (See **Table 6.44.**). The increase in number of outpatient angioplasty and stenting procedures for was greater for Black males (596%) compared to the increase for Whites (273%) (see Figure 6.22). Overall, angioplasty and stenting procedures comprised 5% of all outpatient hospital visits in 2002. This percentage was slightly higher for Whites compared to Blacks, and slightly higher for males compared to females.

Table 6.44. Frequency of Angioplasty and Stenting, 1997-2002, Tennessee, HDDS Outpatient Files

GROUP	1997	1998	1999	2000	2001	2002
Percentage of Procedures						
White Male	385	627	804	1,073	1,249	1,474
White Female	174	242	308	416	487	609
Black Male	19	45	47	53	73	111
Black Female	8	30	24	59	57	77
Total White	559	869	1,112	1,489	1,736	2,083
Total Black	27	75	71	112	130	188
Total Male	440	748	900	1,204	1,384	1,646
Total Female	199	294	359	511	562	704
Total	639	1,042	1,259	1,715	1,946	2,350
Percentage of Procedures						
White Male	3.4%	4.4%	5.5%	5.7%	6.4%	6.8%
White Female	1.9%	2.1%	2.5%	2.7%	3.1%	3.6%
Black Male	1.1%	2.0%	2.6%	2.6%	3.6%	4.4%
Black Female	0.4%	1.2%	1.1%	2.4%	2.4%	2.7%
Total White	2.7%	3.3%	4.1%	4.4%	4.9%	5.4%
Total Black	0.7%	1.6%	1.8%	2.5%	2.9%	3.5%
Total Male	3.2%	4.3%	5.2%	5.4%	5.9%	6.4%
Total Female	1.7%	2.0%	2.4%	2.7%	2.9%	3.4%
Total	2.5%	3.2%	3.9%	4.1%	4.5%	5.1%

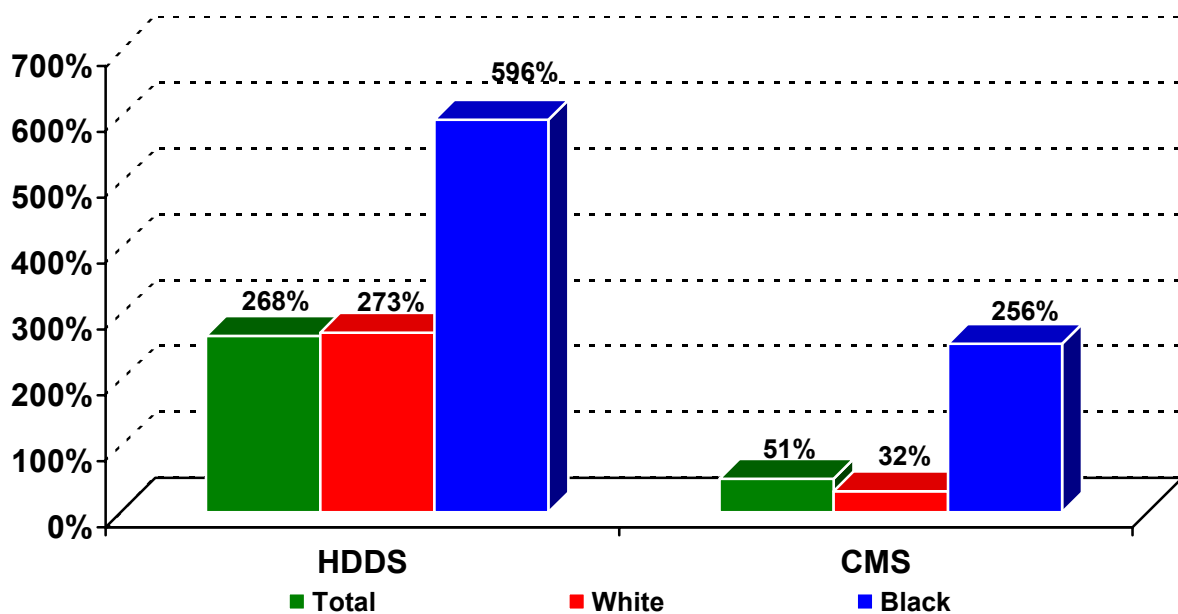


Figure 6.22. Percentage Change in Angioplasty and Stenting Procedures of Patients Diagnosed with Diseases of the Heart 1996/7-2002, Tennessee, HDDS & CMS Outpatient Files

According to CMS outpatient data, the number of angioplasty and stenting procedures performed each year in an outpatient setting on patients age 65 and over increased by 51% from 319 in 1996 to 481 in 2002 (See **Table 6.45**). The increase in number of outpatient angioplasty and stenting procedures for elderly Blacks (256%) was higher than the increase for elderly Whites (32%) (see Figure 6.23). Overall, angioplasty and stenting procedures comprised 0.6% of all outpatient hospital visits among those age 65 and over in 2002. However, this percentage was greater for Blacks compared to Whites.

Table 6.45. Frequency of Angioplasty and Stenting, 1996-2002, Tennessee, CMS Outpatient Files

GROUP	1996	1997	1998	1999	2000	2001	2002
Number of Procedures							
White Male	155	177	259	267	241	169	221
White Female	134	247	167	205	192	144	161
Black Male	10	18	20	28	23	19	40
Black Female	16	35	24	38	35	25	57
Total White	289	424	426	472	433	313	382
Total Black	26	53	44	66	58	44	97
Total Male	167	198	283	296	267	191	262
Total Female	152	288	196	244	227	173	219
Total	319	486	479	540	494	364	481
Percentage of Procedures							
White Male	.6%	.7%	.9%	.9%	.8%	.6%	.7%
White Female	.4%	.7%	.4%	.5%	.5%	.4%	.4%
Black Male	.6%	.8%	.9%	1.3%	1.1%	.9%	1.9%
Black Female	.4%	.9%	.6%	.9%	.8%	.6%	1.4%
Total White	.5%	.7%	.6%	.7%	.6%	.5%	.6%
Total Black	.5%	.8%	.7%	1.1%	.9%	.7%	1.6%
Total Male	.6%	.7%	.9%	.9%	.8%	.6%	.8%
Total Female	.4%	.7%	.5%	.6%	.5%	.4%	.5%
Total	.5%	.7%	.6%	.7%	.7%	.5%	.6%

Figures 6.23 - 6.27 juxtapose the increase in the number of angioplasty/stenting procedures and the cardiac catheterization procedures that were performed in inpatient versus outpatient settings, for both HDDS and CMS databases. Figures 6.23 and 6.24 reveals that the growth in outpatient angioplasty and stenting rose much faster in the HDDS database than the CMS. As seen in Figure 6.25 & 6.26, the number of outpatient procedures for cardiac catheterization increased much faster than the inpatient procedure, especially in the HDDS database.

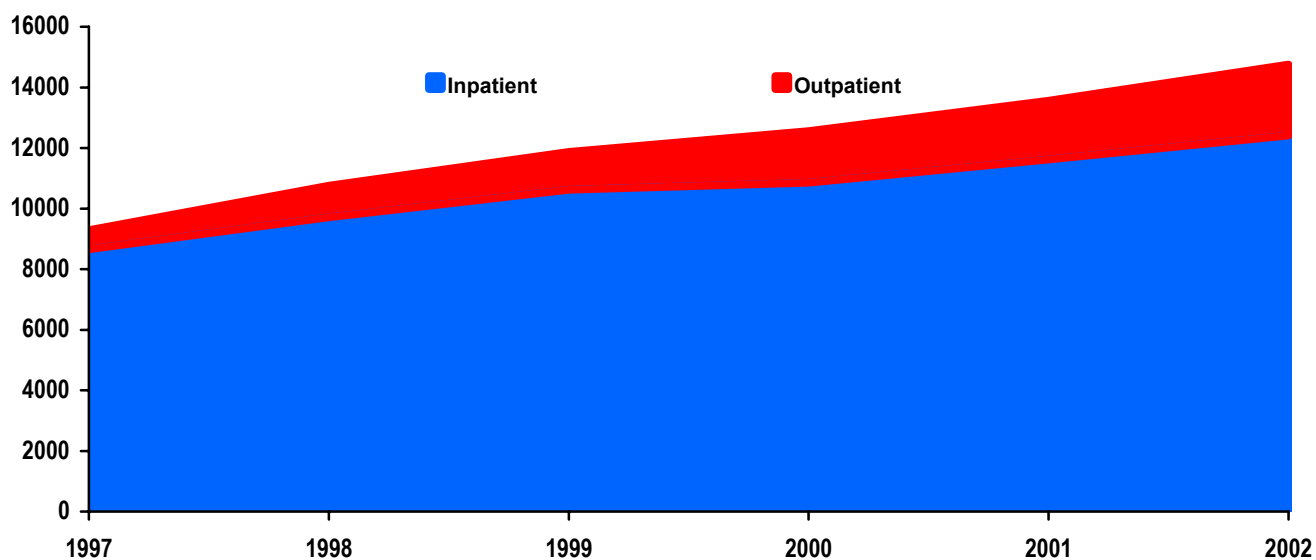


Figure 6.23. Trend of Angioplasty and Stenting Procedures of Patients Diagnosed with Diseases of the Heart 1997-2002, Tennessee, HDDS Inpatient & Outpatient Files

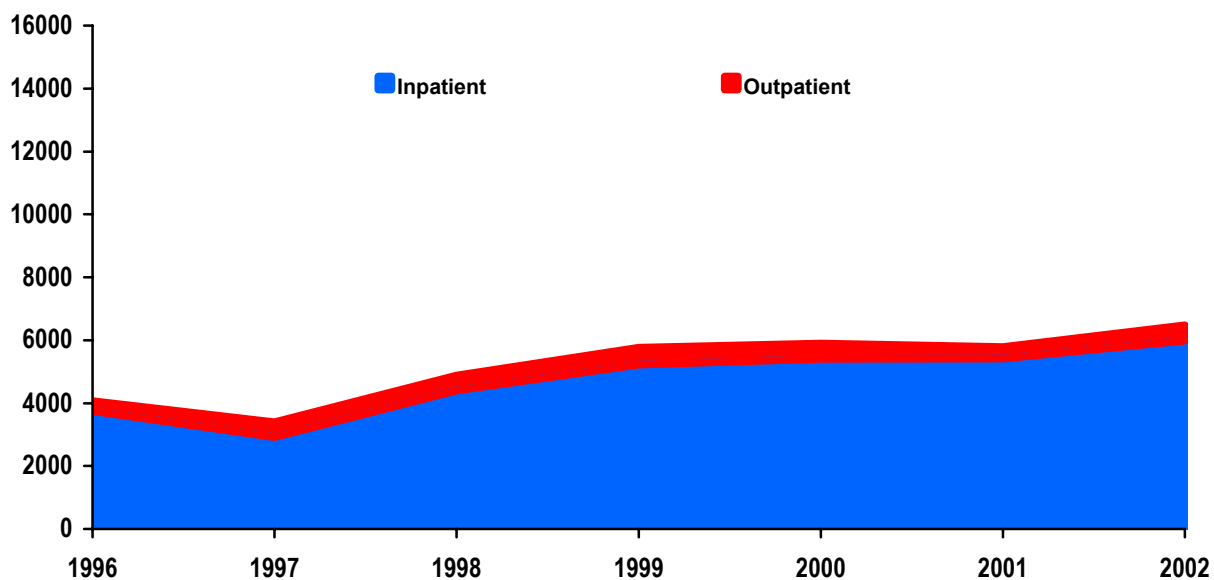


Figure 6.24. Trend of Angioplasty and Stenting Procedures of Patients Diagnosed with Diseases of the Heart 1996-2002, Tennessee, CMS Inpatient & Outpatient Files

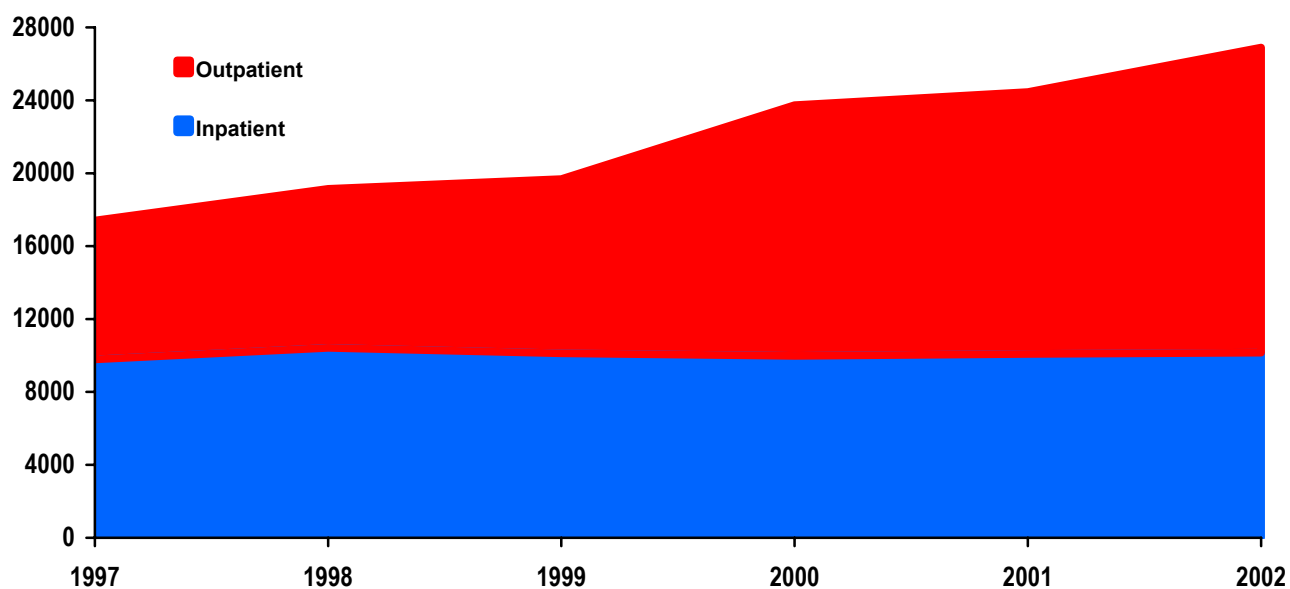


Figure 6.25. Trend of Cardiac Catheterization Procedures of Patients Diagnosed with Diseases of the Heart 1997-2002, Tennessee, HDDS Inpatient & Outpatient Files

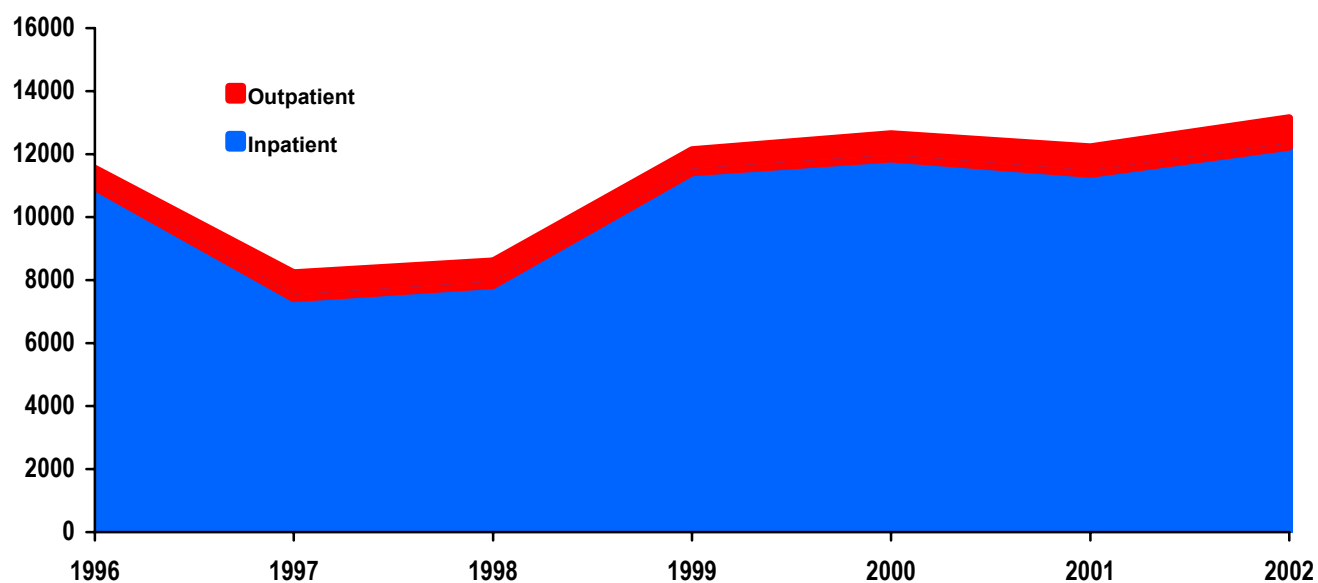


Figure 6.26. Trend of Cardiac Catheterization Procedures of Patients Diagnosed with Diseases of the Heart 1996-2002, Tennessee, CMS Inpatient & Outpatient Files

VII. IMPACT ON HEALTH CARE COST

A. Diseases of the Heart

Diseases of the Heart: Total Cost

- Based on HDDS data, the total cost of inpatient hospitalizations for Tennessee's general population (all ages) increased 61% from \$6.9 billion in 1997 (in 2002 dollars) to \$11.1 billion in 2002. The cost for physician visits among the elderly (65+), based on CMS physician data, increased 33% from \$1.05 billion in 1996 (in 2002 dollars) to \$1.4 billion in 2002.
- Inpatient cost associated with DOH (primary diagnosis) among the general population increased from 1.3 billion in 1997 (in 2002 dollars) to 2.1 billion in 2002, a 62% of increase. Despite the increase in the dollar amount of cost, inpatient DOH cost accounted for about 20% of total inpatient cost for all years from 1997 to 2002, i.e. the increase in DOH cost was similar to that of the total cost for all diseases.
- The cost for physician services associated with DOH among the elderly increased from \$1 billion in 1996 (in 2002 dollars) to \$1.7 billion in 2002, a 70% increase. DOH cost accounted for 8% of total physician services cost in 1996 and 10% in 2002, indicating that DOH physician services cost increased to a greater extent than physician services cost for all diseases.

Diseases of the Heart: Age-Adjusted Per Capita Charges

- Age-adjusted per capita charges reflect the average cost per person in the population accounting for differences in the distribution of the population by age (age-adjusted to 2000 U.S. standard population).
- Among the general population, age-adjusted per capita charges for inpatient services resulting from DOH in constant 2002 dollars increased by 43% from \$253 in 1997 to \$362 in 2002. Compared to the 4% increase in the age-adjusted inpatient hospitalization rate in the same time period (Figure 3.1.), DOH cost increased to a greater extent than the increase in the number of DOH patients receiving inpatient services. This suggests that the increase in DOH inpatient cost was not only due to the increase in services received.

Age-adjusted per capita charges for DOH physician services among the elderly increased by 4.8% from \$186 in 1996 (in 2002 dollars) to \$195 in 2002 (Figure 7.2.). Although this increase was not as dramatic as for DOH inpatient cost, it was 2.4 times the increase in the age-adjusted physician visit rate of 2% (Figure 3.2.).

- For DOH physician services among the elderly, white males had the highest age-adjusted per capita charges in all years and black males, white females, and black females were similar to each other.

For inpatient services white males and black males had the highest age-adjusted per capita charges for all years from 1997 to 2002, followed by black females, with white females having the lowest (Figure 7.1.).

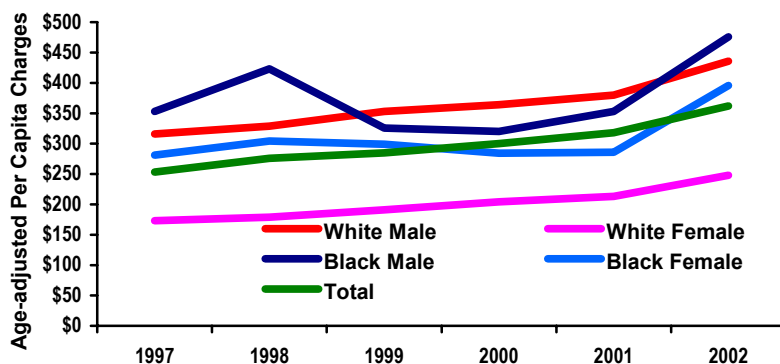


Figure 7.1. Trends in Age-adjusted Per Capita Charges for Disease of the Heart, 1997-2002, Tennessee, HDDS Inpatient File (2002 dollars)

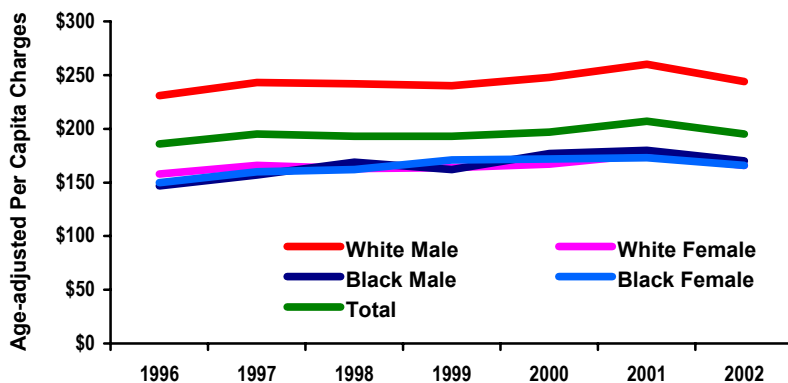


Figure 7.2. Trends in Age-adjusted Per Capita Charges for Disease of the Heart, 1996-2002, Tennessee, CMS Physician File (2002 dollars)

Diseases of the Heart: Cost by Payer

- Medicare payments for inpatient cost associated with DOH for the general population increased 57% from \$845 million in 1997 (in 2002 dollars) to \$1,324 million in 2002. The cost paid by other insurers increased by 44% from \$362 million in 1997 (in 2002 dollars) to \$523 million in 2002. The cost paid by TennCare increased 62% from \$129 million in 1997 (in 2002 dollars) to \$209 million in 2002. These three major payers paid for about 96% of DOH inpatient cost in 2002.
- For inpatient services, regardless of the race-gender group, Medicare was the largest payer for DOH from 1997 to 2002, followed by other insurance coverage, and then TennCare (Figure 7.3.). Self pay and other/unknown payers paid for less than 4% of the DOH cost in 2002.
- Medicare paid a greater proportion of the inpatient cost for females (72% for white females, 64% for black females in 2002) than for males (57% for white males, 52% for black males in 2002).

males, 52% for black males in 2002). TennCare paid a higher percentage of the inpatient cost for blacks (15% for black males, 16% for black females in 2002) than for whites (10% for both white males and white females in 2002). In contrast to Medicare, other insurance coverage paid a smaller proportion of the inpatient cost for females (17% for white females, 15% for black females in 2002) than for males (31% for white males, 25% for black males in 2002) (Figure 7.3.).

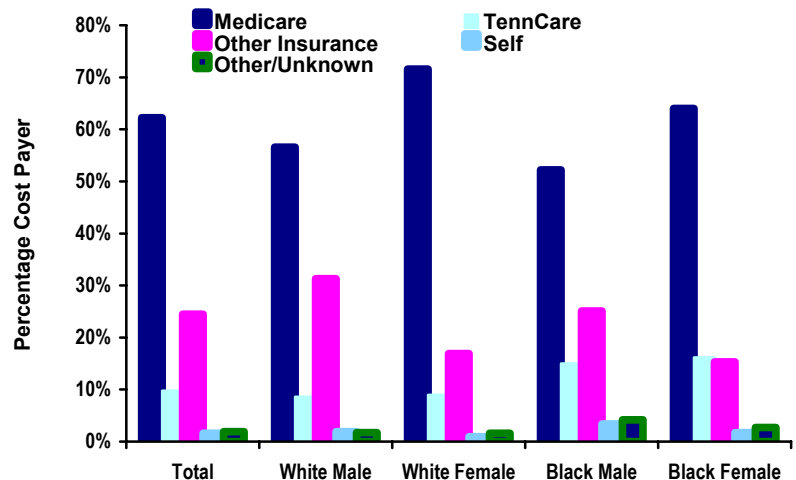


Figure 7.3. Disease of the Heart Cost by Payer, 2002, Tennessee, HDDS Inpatient File

Diseases of the Heart: Relative Cost for Major Types

The three major types of Diseases of Heart considered here are: Coronary Heart Disease (CHD), Myocardial Infarction (MI) and Congestive Heart Failure (CHF). Note that these subtypes of DOH are not mutually exclusive from each other.

- In 2002, CHD accounted for 57% of DOH cost for the general population and 50% of the DOH physician services cost among the elderly.
- White males consistently had the highest relative CHD cost and black females had the lowest, regardless of the types of services and population age range.
- In 2002, MI accounted for 23% of the DOH inpatient cost among the general population and 5% of DOH physician services cost among the elderly.
- The relative cost of MI to diseases of the heart was the highest among white males and lowest among black females for the general population. Such a pattern was also observed for physician services among the elderly.
- In 2002, CHF accounted for 17% of DOH inpatient cost for the general population and 14% of the DOH physician services cost among the elderly.
- Black females had the highest relative CHF cost, followed by black males, then white females and white males. White males had the lowest relative CHF cost from 1996/1997 to 2002 regardless of the type of services and population age range.
- For all three types of DOH, the inflation-adjusted cost increased over time regardless of types of services and the population age range. However, their relative cost to DOH cost remained relatively unchanged from 1996/1997 to 2002.

Diseases of the Heart: Cost for Procedures

In this section, we examine the inpatient cost associated with six major DOH procedures: coronary artery bypass graft,

angioplasty and stenting, cardiac catheterization, heart valve surgery, open heart surgery, and heart transplant.

- Coronary artery bypass graft was the most costly inpatient procedure for the general population, accounting for 22% of DOH inpatient cost. Cost for this procedure increased the least (22% increase after adjusting for inflation) from 1997 to 2002 when compared with other inpatient procedures examined. The second most costly procedure for the general population was angioplasty & stenting (19% of DOH cost in 2002), whose cost doubled (86% increase after adjusting for inflation) from 1997 to 2002. Heart valve surgery cost increased the most (by 185% after adjusting for inflation) from 1997 to 2002, but it only accounted for less than 1% of DOH cost (Figure 7.4).

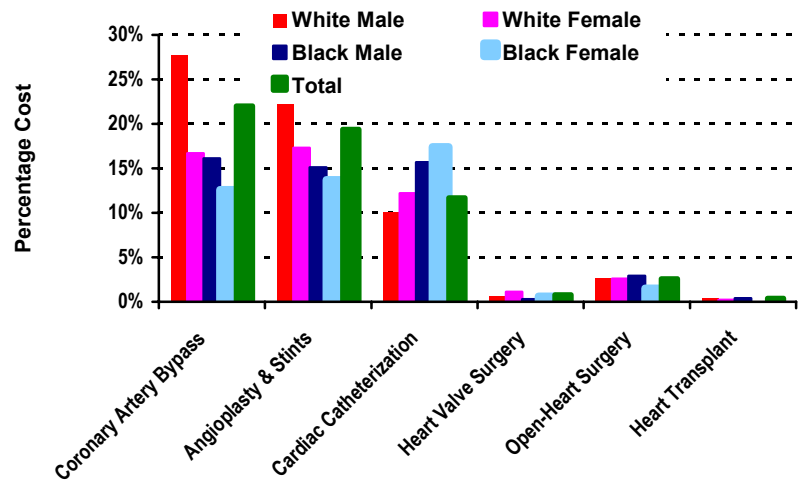


Figure 7.4. Relative Cost for Major Disease of the Heart Procedures, 2002, Tennessee, HDDS Inpatient File

- Cardiac catheterization was the most costly inpatient procedure among the elderly, which accounted for 42% of the DOH inpatient cost. The second most costly inpatient procedure among the elderly was coronary artery bypass graft (Figure 7.5).
- For both the general population and the elderly in 2002, the relative cost for coronary artery bypass graft and angioplasty and stenting was higher for males than females and higher for whites than blacks. For cardiac catheterization, the relative cost was higher for females than males, and higher for blacks than whites in the general population. Among the elderly, the relative cost for cardiac catheterization was higher for males than females and similar for whites and blacks (Figure 7.4, Figure 7.5).

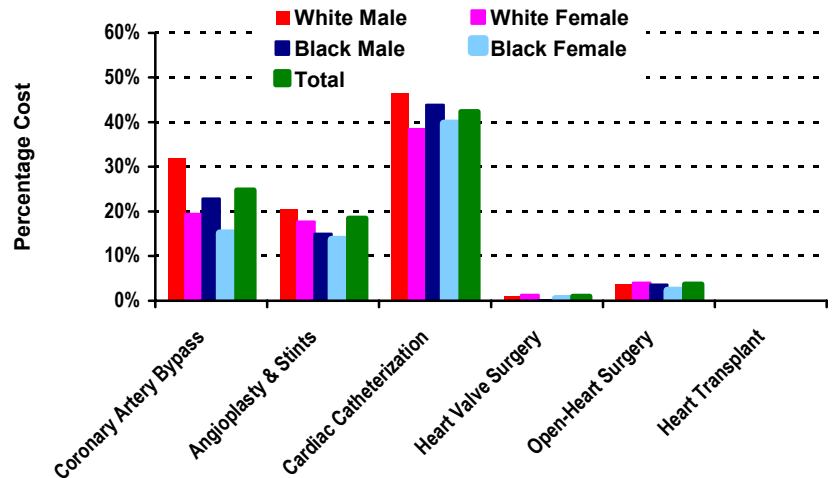


Figure 7.5. Relative Cost for Major Disease of the Heart Procedures, 2002, Tennessee, CMS Inpatient File

B. Stroke

Stroke: Total Cost

- Stroke inpatient cost among the general population (HDDS data) increased by 56% from \$255 million in 1997 (in 2002 dollars) to \$395 million in 2002. Physician services cost for stroke among the elderly increased 2%, from \$41 million in 1996 (in 2002 dollars) to \$42 million in 2002.
- Despite the dollar increases in cost, stroke consistently accounted for about 4% of inpatient cost for all diseases among the general population and 3-4% of physician services cost among the elderly for all years from 1996/1997 to 2002.

Stroke: Age-adjusted Per Capita Cost

- Age-adjusted per capita inpatient charges for stroke services among the general population increased by 45% from \$47 in 1997 (in 2002 dollars) to \$68 in 2002. Age-adjusted per capita charges for blacks were more than twice as high as those for whites in all years from 1997 to 2002, and such gaps widened over time (Figure 7.6.).

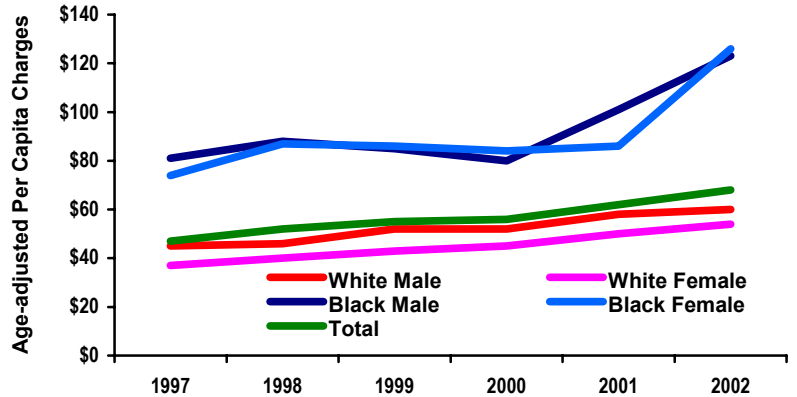


Figure 7.6. Trends in Age-adjusted Per Capita Charges for Stroke, 1997-2002, Tennessee, HDDS Inpatient File (2002 dollars)

- Age-adjusted per capita physician charges for stroke services among the elderly decreased slightly (5%) from \$60 in 1996 (in 2002 dollars) to \$57 in 2002, with white females being slightly lower than other race-gender groups (Figure 7.7.).

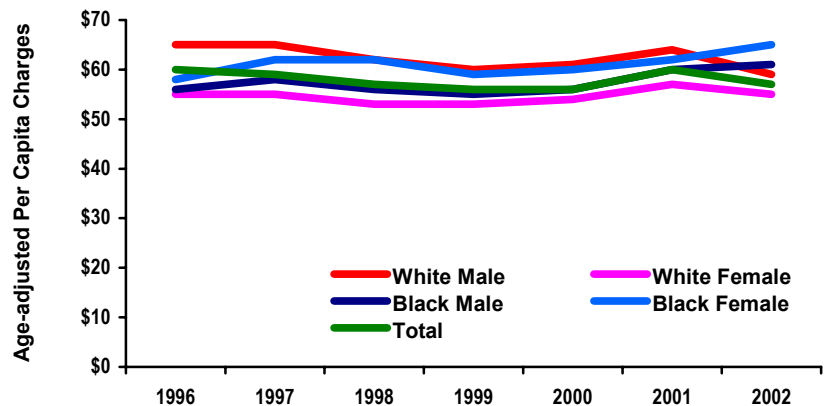


Figure 7.7. Trends in Age-adjusted Per Capita Charges for Stroke, 1996-2002, Tennessee, CMS Physician File (2002 dollars)

Stroke: Cost by Payer

- Medicare paid \$253 million of inpatient stroke cost in 2002, which was a 46% increase from \$173 million in 1997 (in 2002 dollars). Other insurance coverage paid \$80 million in 2002, which was a 54% increase from \$52 million in 1997 (in 2002 dollars). TennCare paid \$37 million in 2002, which was a 68% increase from \$22 million in 1997 (in 2002 dollars). These three major payers paid about 94% of the stroke inpatient cost.
- For inpatient services among all race-gender groups, Medicare bore the largest cost burden, paying 64% of stroke cost for the general population in all years from 1997 to 2002. Other insurance coverage was the second largest payer for all groups with the exception of black females, whose second highest payer was either other

insurance coverage or TennCare (Figure 7.8.).

- Medicare paid a greater proportion of the inpatient stroke cost for females than for males. In contrast, other insurance coverage paid a smaller proportion of the inpatient stroke cost for females than for males.

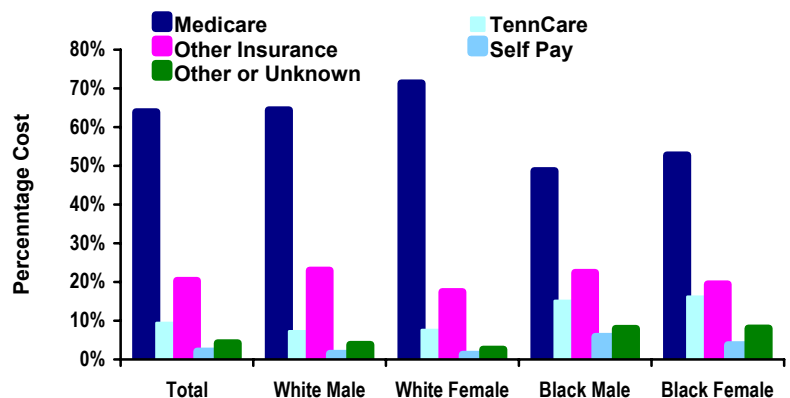


Figure 7.8. Stroke Cost by Payer, 2002, Tennessee, HDDS Inpatient File

C. Hypertension

Hypertension: Total Cost

- Inpatient cost for hypertension among the general population was \$115 million in 2002, which was a 53% increase from 1997 (\$75 million in 2002 dollars). Despite the increase in actual cost, the relative cost of hypertension compared to the cost of all diseases was about 1% for inpatient services for all years from 1997 to 2002. The relative cost for hypertension was consistently higher among blacks than whites and the gap increasing over time (Figure 7.9.).
- The cost of physician services for hypertension among the elderly also increased by 31% from \$35 million in 1996 (in 2002 dollars) to \$46 million in 2002. Hypertension cost accounted for about 5-6% of DOH physician services cost in all years from 1996 to 2002.

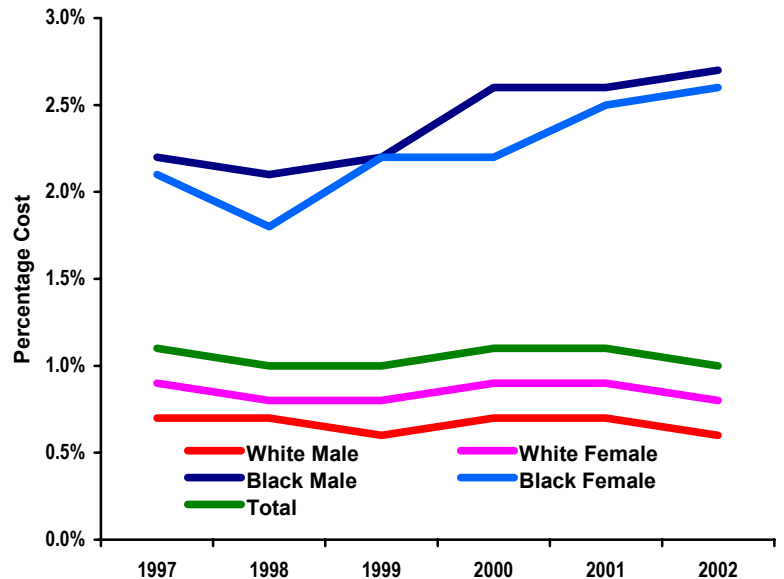


Figure 7.9. Trends in Relative Cost for Hypertension, 1997-2002, Tennessee, HDDS Inpatient File

Hypertension: Age-adjusted Per Capita Charges

- Age-adjusted per capita charges for inpatient services due to hypertension for the general population increased from \$13 per capita in 1997 (in 2002 dollars) to \$20 per capita in 2002, which was a 54% increase (Figure 7.10.).
- Blacks had much higher age-adjusted per capita charges for hypertension than whites and the gaps widened over time. In 2002, the age-adjusted per capita charges for hypertension were more than 5 times higher among blacks (\$75) compared to whites (\$12) (Figure 7.10.).

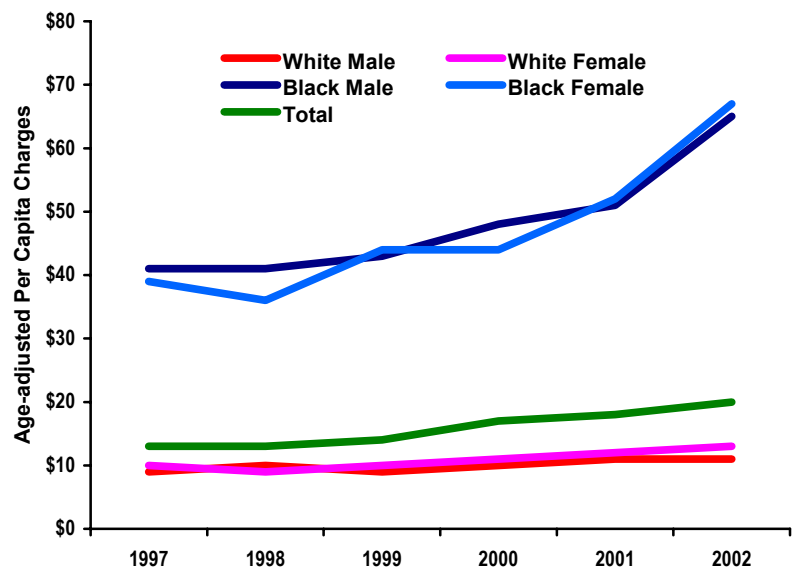


Figure 7.10. Trends in Age-adjusted Per Capita Charges for Hypertension, 1997-2002, Tennessee, HDDS Inpatient File (2002 dollars)

- Age-adjusted per capita charges for physician services due to hypertension among the elderly also increased 40% from \$46 in 1996 (in 2002 dollars) to \$63 in 2002. Black females had the highest age-adjusted per capita charges, white males had the lowest, and black males and white females were in the middle from 1996 to 2002 (Figure 7.11.).

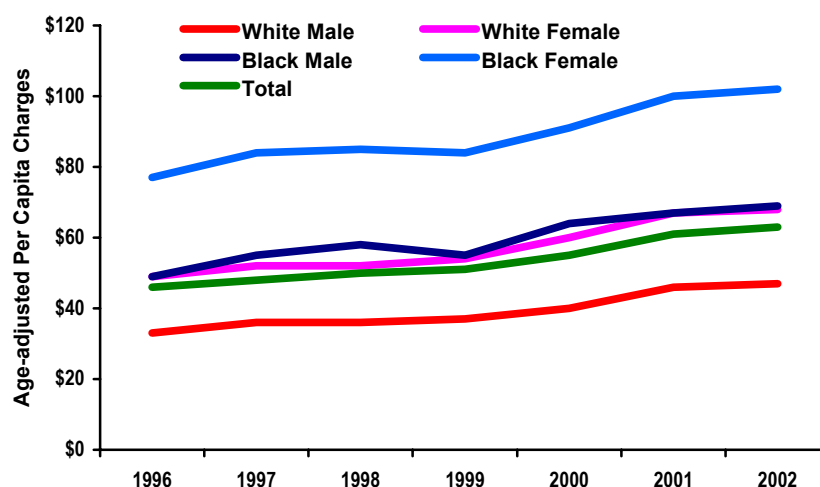


Figure 7.11. Trends in Age-adjusted Per Capita Charges for Hypertension, 1996-2002, Tennessee, CMS Physician File (2002 dollars)

Hypertension: Cost by Payer

- In 2002, Medicare paid for \$75 million for hypertension inpatient services for the general population, which was a 44% increase from \$52 million in 1997 (in 2002 dollars). Hypertension cost paid by other insurance coverage increased by 65% from \$11.9 million in 1997 (in 2002 dollars) to \$19.6 million in 2002. Hypertension cost paid by TennCare increased by 74% from \$8.2 million in 1997 (in 2002 dollars) to \$14.3 million in 2002. These three major payers paid about 94% of the total hypertension cost in 2002.
- Despite the increase in the dollar amount paid by Medicare, the percentage of cost paid by Medicare stayed around 65-69% of inpatient hypertension cost (Figure 7.12.).
- Medicare was the largest payer for inpatient hypertension cost for all race-gender groups, followed by other insurance coverage, with the exception of black females whose second largest payer was TennCare (Figure 7.12.).
- For inpatient services, other insurance coverage paid a higher proportion of the hypertension cost for males (23%) than for females (12.9%) in 2002. In contrast, Medicare paid a higher proportion of the hypertension cost for females (70%) than for males (59%) in 2002. TennCare tended to pay for a higher proportion of hypertension cost for blacks (17.3%) than for whites (8.5%) in 2002 (Figure 7.12.).

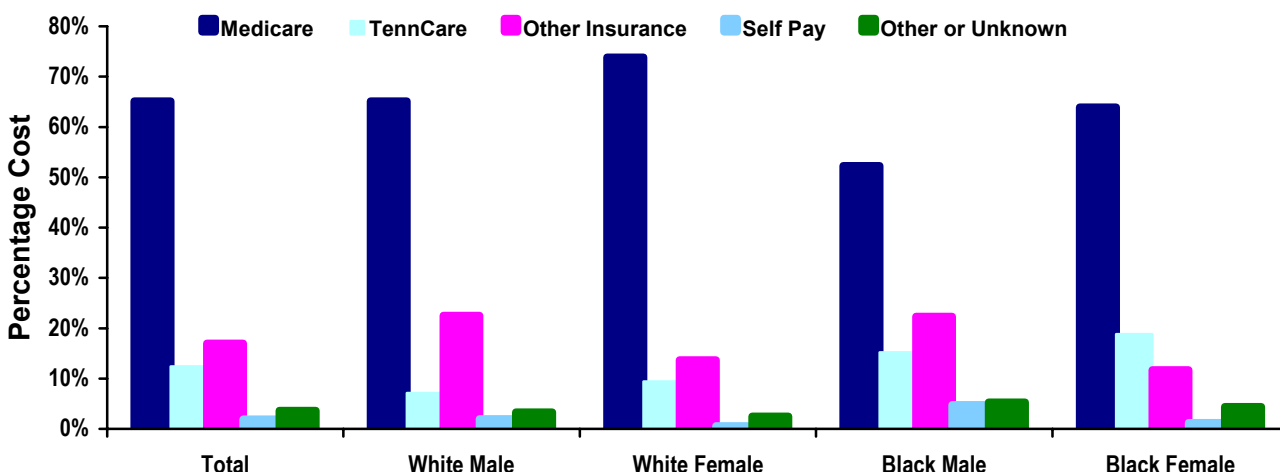


Figure 7.12. Hypertension Cost by Payer, 2002, Tennessee, HDDS Inpatient File

VIII. CONCLUSION

A. Discussion

Diseases of the heart (DOH) and stroke have always been deadly public health problems, and this report shows that Tennessee bears an enormous burden from them; a burden weighed in illness, lives, and costs to individuals, insurers, and state agencies responsible for caring for Tennesseans' health. This report showed that, combined, DOH, stroke, and other CVD are the most common cause of death for Tennesseans, and are responsible for 38% of deaths in Tennessee. To put that in perspective, in 2002, Tennesseans were 73% more likely to die from DOH, stroke or HTN than to die from cancer.

Risk Factors

Altering modifiable risk factors can prevent many people from developing DOH and stroke. Alarming, 9 out of 10 adult Tennesseans reported at least one risk factor and nearly two-thirds reported two or more in the 2002 BRFSS. Of concern is the rapidly increasing trend in obesity among adult Tennesseans, which increased from 17.4% to 24.6% from 1996-2002. Contributing to obesity was the large proportion of adult Tennesseans with poor diet (low consumption of fruits and vegetables), which declined to 62.9% but then rose to 71.6% in 2002. Additionally, lack of adherence to recommended physical activity levels by almost two-thirds of adult Tennesseans has a very negative impact on weight gain and overall heart function. Furthermore, the prevalence of cigarette smoking did not decline, but remained fairly stable ranging from 24-28% of the adult population. Finally, prevalence of self-reported diagnosed high blood cholesterol did not decline, but hovered around one-third of adult Tennesseans, while prevalence of self-reported diagnosed diabetes mellitus showed a steady increase from a low in 1997 (4.4%) to nearly double (8.5%) in 2002. Black females are particularly at risk since they had the highest rates for obesity, sedentary lifestyle and diabetes, and were only slightly lower than Black males in poor diet; however, they did have substantially lower rates of cigarette smoking than all other race/gender groups.

Diseases of the Heart (DOH)

Evidence suggests that DOH prevalence is gradually increasing in Tennessee. The Hospital Discharge Data System (HDDS) data for Tennessee also show that the age-adjusted rate of DOH among inpatients increased by 4% from 1997 to 2002. However for those age 65 and over, CMS inpatient data revealed an 11% increase in the age-adjusted rate of DOH for Blacks while Whites decreased by 4% during 1996-2002. DOH rates were higher for men compared to women and higher for Blacks compared to Whites (although among the elderly, rates of physician-diagnosed DOH were higher for Whites). DOH caused around 16,000 deaths per year in Tennessee, including 13,000 deaths (80%) among the elderly. The age-adjusted mortality rate from DOH decreased by 9% from 313.6 to 284.7 per 100,000 deaths from 1996 to 2002 (which was higher than the national mortality rate from DOH). DOH accounted for 28.7% of all deaths in Tennessee in 2002. DOH mortality rates were higher for men compared to women and higher for Blacks compared to Whites.

DOH includes coronary heart disease (CHD), myocardial infarction (MI), and congestive heart failure (CHF). The age-adjusted rate of CHD among inpatients decreased by 2% in the total population (HDDS, 1997-2002) and decreased by 7% among the elderly (CMS, 1996-2002). The age-adjusted rate of physician-diagnosed CHD among the elderly, however, only decreased by 1% during this time period. Age-adjusted mortality rates from CHD declined from 1996-2002 by 12% for the total Tennessee population (DSSS). Despite this decline, DOH mortality in Tennessee was 6th highest in the nation in 2002, accounting for 28.7% of deaths in that year. However, Blacks had higher mortality from CHD than Whites, even though Whites had the highest rates of CHD diagnoses.

Six percent of the total Tennessee population reported having been diagnosed with a heart attack (MI) (BRFSS, 2001). Age-adjusted rates of MI among inpatients increased by only 3% in the total population (HDDS, 1997-2002) and was about four times higher among elderly inpatients (CMS). Age-adjusted rates of MI were consistently higher for men than women and higher for Blacks compared to Whites as inpatients (but higher for Whites among the elderly). The age-adjusted mortality rate from MI decreased by 17% from 111.3 to 92.1 per 100,000 deaths from 1996 to 2002. MI mortality rates were higher for men compared to women and higher for Whites compared to Blacks.

Age-adjusted rates of CHF among inpatients increased by 7% (HDDS, 1997-2002). Across all years and data sources, the rates of CHF were substantially higher for Blacks compared to Whites, even among the elderly (CMS, 1996-2002). The age-adjusted mortality rate from CHF increased by 10% from 8.1 to 8.9 per 100,000 deaths from 1996 to 2002. CHF mortality rates were higher for men compared to women, although there was no clear racial difference in mortality from CHF.

Stroke

Tennessee is a part of the “Stroke Belt”—the eleven states in the Southeastern United States characterized by relatively extremely high rates of stroke. Tennessee had an overall prevalence of self-reported diagnosed stroke of 3.6% of the total adult population in 2001 (BRFSS). The age-adjusted rate of stroke among inpatients in Tennessee decreased from by 2% 1997-2002 (HDDS). Age-adjusted mortality rates from stroke for 1996-2002 decreased by 11%. Still Tennessee ranked 3rd highest in the nation for stroke mortality, accounting for 7% of all Tennessee deaths in 2002. Stroke mortality rates were higher for Blacks compared to Whites and higher for women compared to men, given that mortality rates from stroke decreased more rapidly for men than women in recent years.

High Blood Pressure, or Hypertension (HTN)

Hypertension (HTN) is both a risk factor for DOH and stroke and a disease on its own. Hypertension affects close to one-third of all adult Tennesseans, and affects Blacks more frequently than Whites and women more frequently than men. About 300,000 elderly had physician-diagnosed HTN in 2002, with an age-adjusted rate of 39,410.7/100,000 that increased by 25% from 1996-2002 (CMS). Co-morbidity of DOH and stroke with HTN is very high with more than *two-thirds* of those with a primary diagnosis of DOH also having a diagnosis of HTN and more than *three-fourths* of those with a primary diagnosis of stroke also have a diagnosis of HTN. The age-adjusted mortality rate from HTN increased by 29% from 20.9 to 26.9 per 100,000 deaths from 1996 to 2002. HTN mortality rates were higher for men compared to women (even though women had higher rates as inpatients), and three times higher for Blacks compared to Whites.

Utilization and Procedures

While inpatient hospitalizations for DOH in the 65 years and older increased by only 5%, there were decreases in inpatient hospitalizations for both stroke (23%) and HTN (3%). For the general population, inpatient hospitalization did increase modestly with DOH by 11%, stroke by 8% and HTN by 4%. Contrastingly, number of outpatient visits for DOH for the general population increased by 80%, for stroke by 92% and HTN by 79%. For the elderly, outpatient visits increased for DOH by 15% and for HTN by 31%, with a slight decrease in number of visits for stroke (3%). Although there were only modest increases in inpatient hospitalization for DOH, total cardiac and vascular inpatient procedures increased by 21% for general population and 20% for the elderly. Outpatient cardiac catheterization increased dramatically by 120% for the general population and also increased noticeably for the elderly (55%) during 1996/7-2002. Angioplasty and stenting had an even more dramatic increase for the general population (268%) and a substantial increase for the elderly (51%).

Costs

Inpatient and outpatient hospital cost for DOH, stroke and HTN totaled \$3 billion in 2002, and accounted for 20% of total hospitalization cost for all causes. In addition, the cost for physician services for these three conditions among the elderly was \$231 million in 2002. Medicare and TennCare paid for the majority of hospitalization cost from DOH, stroke and HTN; together these federal and state sponsored providers footed the bill for 70% of inpatient and outpatient hospital cost for these conditions—\$2.1 billion in 2002. Medicare paid for a higher proportion of the cost for females than males and a higher proportion for Whites than Blacks while TennCare paid for a higher proportion of the cost for Blacks than Whites. Private insurance company paid a higher proportion of cost for males than females. The age-adjusted per capita cost for inpatient hospitalization increased 60% for DOH, 62% for stroke and 72% for HTN from 1997 to 2002; more than 12% increase per year and far outpacing inflation. Similar to the race-gender pattern observed for mortality and inpatients, the age-adjusted per capita cost for inpatient services was much higher for Blacks than Whites for stroke and HTN and higher for males than females for DOH.

Racial and Gender Differences

Blacks had a heavier disease burden of DOH, CHF, stroke, and HTN in the general population. The DOH rate among inpatients increased most rapidly for Black males. However, among the elderly, rates of physician-diagnosed DOH and stroke were higher for Whites, particularly White males. MI affected White males more

frequently than other groups, while HTN affected females more frequently than males, especially Black females. Blacks (especially Black males) were more likely to die from DOH and stroke than Whites. MI and CHF mortality rates were both higher for males compared to females, but MI mortality was higher for Whites (particularly White males) while CHF mortality was higher for Blacks. Black females would appear to be most at risk for heart disease and stroke since they have the highest prevalence of obesity, sedentary lifestyle, diabetes and high blood pressure, and were only slightly lower than Black males in poor diet. However, Black females actually have lower DOH and MI mortality than White and Black males and lower stroke mortality than Black males. In addition the relative protective advantage that females in general have compared to males for developing heart disease, the considerably lower prevalence of smoking among Black females may partially counteract their other risk factors.

Black Tennesseans were more likely to seek emergency treatment for DOH or stroke compared to Whites, which demonstrates a greater use of acute care. Black Tennesseans hospitalized for DOH or stroke stayed more days than Whites, which is an indication of greater severity. Elderly Blacks (especially Black males) had more physician visits for DOH or stroke than Whites. However, the frequency of outpatient visits for DOH and stroke grew more rapidly for Whites compared to Blacks, which may reflect greater use of therapeutic treatments to prevent first or recurring cardiovascular events and complications (i.e., secondary prevention). In terms of specific procedures, the frequency of open heart surgery and heart valve surgery increased more rapidly for Whites, while the frequency of outpatient angioplasty/stenting and cardiac catheterization grew more rapidly for Blacks.

Geographic Variation

Age-adjusted rates of DOH, stroke, and HTN, and age-adjusted mortality rates from these causes varied substantially across Tennessee counties. For example, in terms of the rate of DOH among inpatients, the highest county rate was more than 4 times greater than the lowest county rate (and 3 times greater for stroke). The rates of physician-diagnosed DOH and HTN among the elderly were about 2½ times greater, the DOH mortality rate was 2 times greater, and the stroke mortality rate was nearly 5 times greater in the highest versus lowest counties. However, there were no clear patterns in the distribution of higher and lower disease or mortality rates across geographic regions of the state. In addition, counties with high (or low) rates of disease did not necessarily have high (or low) mortality rates from that disease. Therefore, general statements of geographic trends are not possible, and the findings for each county must be interpreted in its respective context. Interestingly, there were clearly different patterns by race in terms of which counties were highest and lowest in disease burden and mortality.

B. Policy Implications

Regions of the state with high disease burden and/or high mortality from DOH, stroke or HTN should be targeted for educational and health care delivery programs to promote changes in modifiable risk factors like diet, exercise, and smoking and to help citizens manage chronic morbidity. The county-level rates for disease burden and mortality for Black females and especially Black males must be interpreted carefully, though, since many non-urban Tennessee counties have small Black populations. Thus, age-adjusted rates must be interpreted in conjunction with the size of the Black female and Black male population in the respective county when making program decisions.

Racial disparities in disease burden are not only influenced by differences in modifiable risk factors, but also by differences in the prevalence of co-occurring conditions. In particular, diabetes mellitus and hypertension disproportionately affect Black Tennesseans, which both of which increase risk for developing heart disease and stroke and accompanying complications. Previous research also suggests that racial disparities in health outcomes may be partially eliminated through increasing regular physician visits for elderly Black Tennesseans.^{20,21,22}

Racial disparities in heart disease and stroke outcomes are not only costly in terms of lives, but also the costs paid by families, businesses, and the state and federal government. In particular, hospitalization costs are higher for Blacks for stroke and HTN regardless of gender. Black females have higher hospitalization costs than White females for DOH. Part of the racial differences in inpatient costs as well as mortality may be due to the fact that Blacks are more likely to be admitted to the hospital through the ER, when conditions have already become acute and more severe (as opposed to receiving elective procedures before conditions become severe). Another contributing factor is the fact that Blacks tend to have longer stays when they are hospitalized, which is also an indicator of severity and complications.

Overall, the increased use of expensive procedures to treat DOH and prevent first or recurring attacks has likely contributed to the rise in inflation-adjusted costs for DOH and stroke. However, most importantly, the increased use of treatment innovations has likely contributed to the declines in DOH and stroke mortality. Further

improvements in DOH and stroke mortality may be achieved by promoting the adherence to evidence-based disease management and treatment guidelines across the state.

C. Resource and Research Needs

Areas of Tennessee with low disease burden and/or mortality from DOH, stroke or HTN should be studied for “best practices” to help determine what policies, programs or infrastructure might effectively lower rates in other comparable areas. Research should focus on the transfer of effective health education and behavior modification programs that target modifiable risk factors into community-based settings. In order for such programs to be culturally competent and successful, it is important for community members and organizations to participate actively as partners.

Research should investigate whether other factors help to explain racial disparities in disease burden and mortality, such as socioeconomic status, access to health care, and health literacy. Also, ER utilization and length of stay data suggest that Blacks may be sicker when they arrive at hospitals, which would contribute to higher mortality rates. We need to understand more about the role of sudden cardiac deaths, which could possibly affect Black Tennesseans disproportionately given their lower rates of DOH as inpatients but higher mortality rates. Research should also investigate possible racial biases in the health care system.

More data resources need to be developed for surveillance of heart disease and stroke disease burden, mortality, and adherence to treatment guidelines. For example, the establishment of a stroke registry would be an invaluable public health surveillance tool. Furthermore, heart disease and stroke data are not currently available for the growing Hispanic population in Tennessee, which could be another disparity population.

IX REFERENCES

- American Heart Association. Heart Disease and Stroke Statistics – 2005 Update. Dallas, Texas: American Heart Association; 2005.
- Lethbridge-Cejku, M., Vickerie, J. (2005). Summary health statistics for U.S. adults: National Health Interview Survey, 2003. *Vital and Health Statistics*, 10(225). Hyattsville, MD: National Center for Health Statistics.
- Kochanek, K.D., Murphy, S.L., Anderson, R.N., Scott, C. (2004). Deaths: Final data for 2002. *National Vital Statistics Report*, 53(5). Hyattsville, MD: National Center for Health Statistics.
- Anderson, R.N. (1999). United States life tables eliminating certain causes of death. *U.S. Decennial Life Tables 1989-91*, 1(4). Hyattsville, MD: National Center for Health Statistics.
- Jones, D.W., Chambless, L.E., Folsom, A.R., Heiss, G., Hutchinson, R.G., Sharrett, A.R., Szklo, M., & Taylor, H.A., Jr. (2002). Risk factors for coronary heart disease in African Americans: the atherosclerosis risk in communities study, 1987-1997. *Archives of Internal Medicine*, 162(22), 2565-71.
- Hurst, W. (2002). *The Heart, Arteries, and Veins*. 10th ed. New York: McGraw Hill.
- Lloyd-Jones, D.M., Lansom, M.G., Leip, E.P., Beiser, A., D'Agostino, R.B., Kannel, W.B., Murabito, J.M., Vasan, R.S., Benjamin, E.J., Levy, D; Framingham Heart Study. (2002). *Circulation*, 106, 3068-72.
- Muntner, P., Garrett, E., Klag, M.J., & Coresh, J. (2002). Trends in stroke prevalence between 1973 and 1991 in the US population 25 to 74 years of age. *Stroke*, 33(5), 1209-13.
- Price, T.R., Psaty, B., O'Leary, D., Burke, G., & Gardin, J. (1993). Assessment of cerebrovascular disease in the Cardiovascular Health Study. *Annals of Epidemiology*, 3(5), 504-7.
- Field, L.E., Burt, V.L., Cutler, J.A., Hughes, J., Roccella, E.J., & Sorlie, P. (2004). The burden of adult hypertension in the United States 1999 to 2000: a rising tide. *Hypertension*, 44(4), 398-404.
- Centers for Disease Control & Prevention. (2001). State-specific trends in high blood cholesterol awareness among persons screened—United States. *MMWR*, 50(35), 754-8.
- Centers for Disease Control and Prevention. (2000). State-specific cholesterol screening trends—United States, 1991-1999. *MMWR*. 49(33), 750-5.
- U.S. Department of Health & Human Services. (2001). Third Report of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. National Heart, Lung and Blood Institute. NIH Publication No. 01-3670.
- Bibbins-Domingo, K., Lim, F., Vittinghoff, E., Barrett-Connor, E., Hulley, S.B., Grady, D., & Shlipak, M.G. (2004). *Circulation*, 110, 1424-30.
- Centers for Disease Control and Prevention. (2003). Diabetes prevalence among American Indians and Alaska Natives and the overall population—United States, 1994-2002. *MMWR*, 52(30), 702-4.
- Harris, M.I., Flegal, K.M., Cowie, C.C., Eberhardt, M.S., Goldstein, D.E., Little, R.R., Wiedmeyer, H.M., & Byrd-Holt, D.D. (1998). *Diabetes Care*, 21(4), 518-24.
- Centers for Disease Control & Prevention. (2003). Prevalence of diabetes and impaired fasting glucose in adults—United States, 1999-2000. *MMWR*, 52(35), 833-7.
- Hedley, A.A., Ogden, C.L., Johnson, C.L., Carroll, M.D., Curtin, L.R., & Flegal, K.M. (2004). Prevalence of overweight and obesity among US children, adolescents, and adults. *JAMA* 291(23), 2847-50.
- Suk, S.H., Sacco, R.L., Boden-Albala, B., Cheun, J.F., Pittman, J.G., Elkind, M.S., & Paik, M.C., Northern Manhattan Stroke Study. (2003). *Stroke*, 34(7), 1586-92.
- Rodriguez, B.L., D'Agostino, R., Abbott, R.D., Kagan, A., Burchfield, C.M., Yano, K., Ross, G.W., Silbershatz, H., Higgins, M.W., Popper, J., Wolf, P.A., & Curb, J.D. (2002). *Stroke* 33(1), 230-6.
- Peeters, A., Berendregt, J.J., Willekens, F., Mackenbach, J.P., Al Mamun, A., Bonneux, L.; NEDCOM, the Netherlands Epidemiology and Demography compression of Morbidity Research Group. (2003). *Annals of Internal Medicine*, 138(1), 24-32.
- U.S. Department of Health & Human Services. (2004). Trends in the Health of Americans. *Health, United States, 2004*, <http://www.cdc.gov/nch/hus.htm>. Accessed July, 2004.
- Centers for Disease Control & Prevention. (1999). Cigarette Smoking among adults—United States, 1997. *MMWR*, 48(43), 993-6.
- U.S. Department of Health & Human Services. (1998). *Reducing the Health Consequences of Smoking – 25 Years in Progress: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health & Human Services, CDC. Accessed February, 2004.
- Goldenberg, I., Jonas, M., Tenenbaum, A., Boyko, V., Matezky, S., Shotan, A., Behar, S., & Reicher-Reiss, H., Bezafibrate Infarction Prevention Study Group. (2003). *Archives of Internal Medicine*, 163(19), 2301-5.

26. Nowotny, T.E. & Giovino, G.A., (1998). Tobacco Use. In: Brownson, R.C., Remington, P.L., Davis, J.R., (eds). *Chronic Disease Epidemiology and Control*, Washington, DC: American Public Health Association, 117-148.
27. Centers for Disease Control & Prevention. *Vital and Health Statistics, 10(219)*. Hyattsville, MD: National Center for Health Statistics. <http://www.cdc.gov/nchs/>. Accessed Feb. 2004
28. Centers for Disease Control & Prevention. (2004). Prevalence of no leisure-time physical activity—35 States and the District of Columbia, 1988-2002. *MMWR*, 53(4), 82-6.
29. Pate, R.R., Pratt, M., Blair, S.N., Haskel, W.L., Macera, C.A., Bouchard, C., Buchner, D., Ettinger, W., Heath, G.W., & King, A.C., et al. (1995). Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA*, 273(5), 402-7.
30. Hu, F.B., Stampfer, M.J., Colditz, G.A., Ascherio, A., Rexrode, K.M., Willett, W.C., & Manson, J.E. (2000). Physical activity and risk of stroke in women. *JAMA*, 283(22), 2961-7.
31. Li, R., Serdula, M., Bland, S., Mokdad, A., Bowman, B., & Nelson, D., (2000). Trends in fruit and vegetable consumption among adults in 16 US states: Behavioral Risk Factor Surveillance System, 1990-1996. *American Journal of Public Health*, 90(5), 777-81.
32. Popkin, B.M., Siega-Riz, A.M., Haines, P.S., & Jahns, L. (2001). Where's the fat? Trends in U.S. diets 1965-1996. *Preventive Medicine*, 32(3), 245-54.
33. Centers for Disease Control & Prevention. (2003). Atrial fibrillation as a contributing cause of death and Medicare hospitalization—United States, 1999. *MMWR*, 52(7), 128, 130-1.
34. Husaini, Baqar A., Darren E. Sherkat, Robert Levine, Charles Holzer, and Van Cain. (2003). "The Influence of Race, Gender, and Mental Disorder on Healthcare Service Utilization and Costs Among the Medicare Elderly." *Research in Healthcare Financial Management*. 8, 19-30.
35. Husaini, Baqar, Darren E. Sherkat, Robert Levine, and Van A. Cain. (2003). "Race and Gender Differences in the Impact of Dementia on Health Service Utilization and Costs." *Psychiatric Services*. 54(1), 92-96.
36. Husaini, Baqar A., Darren E. Sherkat, Robert Levine, Richard Bragg, Charles Holzer, Kathryn Anderson, Van Cain, & Carmen Moten. (2002). "Race, Gender, and Health Care Service Utilization and Costs Among Medicare Elderly with Psychiatric Diagnoses." *Journal of Aging and Health*. 14, 79-86.
37. Sherkat, Darren E. Baqar Husaini, Robert Levine, Clinton Craun, and Van Cain. (2004). "The influence of Race, Socioeconomic Status, and Psychiatric Morbidity on Healthcare Utilization and Expenditures over the life course." Forthcoming, *Research in Healthcare Financial Management*.
38. Sherkat, Darren E., Barbara S. Kilbourne, Van Cain, Robert Levine, and Baqar Husaini. "Explaining Race Differences in Mortality among the Medicare Elderly: The Role of Physician Service Utilization." Forthcoming in *Journal of Healthcare for the Poor and Underserved*.

X. APPENDICES

A. Technical Notes

Data Sources

Behavioral Risk Factor Surveillance System (BRFSS): The BRFSS is an annual state-based, random-digit-dialed telephone survey of the U.S. non-institutionalized population, 18 years of age and older. It gathers self-reported data on prevalence of certain conditions and behavioral risk factors. The annual sample sizes in 1996 – 2002 for Tennessee range from 2,913 to 3,207. BRFSS data are weighted to the Tennessee population by age, sex, race, and probability of selection using a three-stage cluster sampling methodology. The sample size of the BRFSS surveys does not allow for reporting county-level data.

BRFSS Measures

The Tennessee BRFSS surveys for 1996 through 2002 were used to obtain annual data on overall prevalence of three types of CVD (heart attack, stroke, and high blood pressure) and seven modifiable risk factors for CVD (poor dietary habits, sedentary lifestyle, current cigarette smoking, obesity, high blood pressure, high blood cholesterol, and diabetes mellitus) in the state. Data were not available on physical inactivity in 2002 because the BRFSS question on physical activity was changed to include all physical activity, including occupational, which is not comparable to previous years. Respondents who answered “don’t know/not sure” or refused to answer a question were excluded from the analyses for that question. The operationalization of the BRFSS variables and their years of availability are listed below:

1. **Heart Attack** (2001): Individuals who have ever been told by a doctor that they had a heart attack
2. **Stroke** (2001): Individuals who have ever been told by a doctor that they had a stroke
3. **High blood pressure** (1996-2002): Individuals who were told by a doctor that their blood pressure was high
4. **Poor dietary habits** (1996, 1998, 2000-2002): Individuals who consumed less than five servings of fruits and vegetables per day.
5. **Sedentary lifestyle** (1996-2001): Individuals who were “physically inactive” (no leisure-time activity reported during the last month) or who participate in “irregular activity” (any activity or pair of activities, done for less than 20 minutes or done less than three times per week during the month).
6. **High blood cholesterol** (1996-2002): Individuals who were told by a doctor or other health professional that their blood cholesterol was high. (The BRFSS does not ask separately about HDL (“good”) cholesterol and LDL (“bad”) cholesterol, which is the type that poses the risk for cardiovascular disease.)
7. **Current cigarette smoking** (1996-2002): Individuals who smoked at least 100 cigarettes in one’s lifetime and currently smoke every day or some days.
8. **Obesity** (1996-2002): Individuals with Body Mass Index (BMI) greater than or equal to 30.
9. **Diabetes Mellitus** (1996-2002): Individuals who have ever been told by a doctor that they have diabetes mellitus.

Hospital Discharge System (HDDS): The HDDS (1997-2002) is an annual state-based compilation of data on patients discharged from all hospitals licensed by the Tennessee Department of Health. The HDDS does not include federal facilities (i.e., VA hospitals, etc.) and facilities licensed by the Tennessee Department of Mental Health and Developmental Disabilities. The database comes in two parts, the inpatient and outpatient files. Basic demographic information is provided (i.e. id number, sex, race, county of residence, zip code of residence, type of insurance, etc.) Diagnoses and procedures for each discharge are provided based on the ICD-9-CM coding system. The total cost of each hospital or outpatient visit is provided, as well as costs associated with each procedure. However, costs related to professional services (i.e., physician/provider billings) are not included in the HDDS data files. The data are provided as discharge-level (i.e., event-level) files for each year, which were then aggregated to the individual-level (see below for details). Some utilization and costs analyses were also performed on the discharge-level data. The number of patients in the inpatient service files each year ranges from 453,958 in 1997 to 521,032 in 2002, while outpatient service files range from 1,048,887 in 1997 to 1,669,347 in 2002 (note: these figures refer to the individual-level files).

The majority of the HDDS analyses contained in this report were conducted at the person/individual-level as opposed to the discharge/event-level. At the discharge-level, an individual may have multiple billings within a single year. For instance, if a person was hospitalized on three separate occasions within one year, he/she would show-up in the HDDS Inpatient file three times for that year. However, when the discharges are aggregated to the individual-level, each observation represents a unique, individually identifiable record (i.e., the person referred to

above would have one record containing all of his/her information). Throughout the report, all information pertaining to discharge-level analyses is labeled accordingly.

HDDS records were aggregated from the discharge-level to the individual-level using the following criteria: When a patient id number was available, the records were aggregated using the patient id number, date of birth, sex, and race. When the patient id number was missing, the hospital record number, date of birth, sex, and race were used to aggregate the data. However, in the 1999 HDDS inpatient and outpatient files, the hospital record number was missing. Therefore, the HDDS 1999 records with a missing patient id number were aggregated using the date of birth, sex, and race. Only Tennessee residents are included in the analyses.

Follow the link provided below for additional information on the Tennessee Hospital Discharge Data System¹: <http://www2.state.tn.us/health/statistics/PdfFiles/HDDS.pdf>.

Medicare Billing Data (CMS): Medicare billing data for 1996-2002 were obtained from the Centers for Medicare and Medicaid Services (CMS). The CMS data contain a 100% sample (i.e., the entire population) of Medicare beneficiaries residing in Tennessee who utilized services under Part A or Part B coverage between 1996 and 2002. Nearly all Tennessee residents age 65 and older are enrolled in Part A, and Part B (optional coverage) enrollees comprise 97.5% of the age 65 and over population in Tennessee. The CMS data files provide the diagnoses, procedures performed, date of visit, date of procedure, place of service, provider's zip code, place of residence by county and zip code, costs of services provided for all beneficiaries, etc.. In addition to the traditional Medicare-eligible population (i.e., those aged 65 and older), the CMS data also include records for beneficiaries who qualify for coverage due to a documented disability. Medicare beneficiaries who qualify because of a disability are under the age of 65 and highly idiosyncratic. The intended use of the CMS data in this report is to provide an overview of diseases of the heart and stroke among Tennesseans ages 65 and older. Therefore, all beneficiaries under the age of 65 were excluded from analyses. The CMS data analyzed in this report utilize four separate files: the enrollment database (EDB), inpatient, outpatient, and physician billing (carrier) files. The number of beneficiaries age 65 and older in each year ranges from 688,369 in 1996 to 728,560 in 2002.

The EDB files contain basic demographic information (i.e., date of birth, date of death, gender, race, type of coverage, etc.) and a unique individual identifier for all Medicare beneficiaries enrolled in Tennessee for each year. The CMS inpatient files contain billings from inpatient facilities. The CMS outpatient files contain billings from outpatient facilities. The data contained in these files are equivalent to the HDDS inpatient and outpatient files, with one major exception: They do not exclude records from federally funded facilities and facilities licensed by the Tennessee Department of Mental Health and Developmental Disabilities. This is important because many beneficiaries over the age of 65 (especially males) receive a great deal of their medical care from facilities run by the Veterans Administration (VA), and these records are not collected by the Hospital Discharge Data System. The largest set of CMS data files are the physician billing files, commonly referred to as the carrier files. The carrier files provide a close approximation to one-year prevalence of physician-diagnosed conditions among the 65 and over population, since it includes bills for physician visits in any setting (i.e., at the physician's office, at a hospital, at an emergency room, at long-term care facilities, or at a patient's home). Beneficiary diagnoses and procedures performed are coded using the ICD-9-CM system in the CMS inpatient and outpatient files. In the carrier files, beneficiary diagnoses are coded using the ICD-9-CM and procedures performed are coded using Current Procedural Terminology (CPT) codes.

As was the case with the HDDS files, the CMS inpatient, outpatient, and carrier files were initially at the event-level. Thus, these files were also aggregated to the individual-level for the majority of the analyses in the report. The EDB file was merged onto the CMS inpatient, outpatient, and carrier files. The event-level files were aggregated to the individual-level using the unique individual identifier for each beneficiary. There were no missing individual identifiers and all data had complete demographic information. Finally, as is the case with the HDDS files, CMS results presented at the event-level are noted accordingly.

Death Statistical Summary System (DSSS): The DSSS (1996-2002) is an annual state-based compilation of mortality data. The dataset contains basic demographic data (i.e., sex, race, county of residence, zip code of residence, etc.). For 1996 through 1998, the cause of death is coded in ICD-9-CM format. From 1999 to 2002, the cause of death is coded in ICD-10 format, which also lists secondary causes of death. However, in this report only the underlying cause of death is analyzed. Caution must be exercised when comparing death data between the ICD-9 system and the ICD-10 system. For additional information concerning the comparability of ICD-9 and ICD-10 codes, refer to National Vital Statistics Report 49(2)²

(http://www.cdc.gov/nchs/data/nvsr/nvsr49/nvsr49_02.pdf).

The analyses are limited to the records of Tennessee resident decedents. The number of cases ranges from 51,367 in 1996 to 56,513 in 2002.

Diagnosis (ICD-9-CM & ICD-10), Mortality (ICD-9-CM & ICD-10), and Procedure Codes (ICD-9-CM & CPT)

Diagnosis & Mortality Codes: Diagnoses in the HDDS and CMS files are coded using the ICD-9-CM diagnostic coding system. Both the ICD-9-CM and the ICD-10 coding systems were used to code mortality data in the DSSS files. For the DSSS, the ICD-9-CM system is used in 1996 through 1998, and the ICD-10 system is used in 1999 through 2002. The specific ICD-9-CM and ICD-10 diagnosis code ranges used in this report are as follows:

Table A.1: ICD-9-CM & ICD-10 diagnosis codes used in report

Disease Categories	ICD-9-CM Code(s)	ICD-10 Code(s)
Diseases of the Heart		
<i>Diseases of the Heart</i>	390 - 398, 402, 404 - 429	I00 - I09, I11, I13, 120 - I51
<i>Coronary Heart Disease</i>	410 - 414, 429.2	I20 - 125
<i>Myocardial Infarction</i>	410	I21 - I22
<i>Congestive Heart Failure</i>	428.0	I50.0
Stroke		
<i>Total Stroke</i>	430 - 438	I60 - I69
<i>Transient Ischemic Attack</i>	435	I65
Hypertension	401 - 404	I10 - I13
Other Diseases		
<i>Diabetes Mellitus</i>	250	Not Applicable
<i>High Cholesterol</i>	272.0	Not Applicable

Procedure Codes: Procedures in the HDDS inpatient and outpatient files and the CMS inpatient files are coded using the ICD-9-CM coding system. Procedures in the CMS outpatient and physician billing (carrier) files are coded using Current Procedural Terminology (CPT, 2004) coding system. The table below displays the specific ICD-9-CM and ICD-10 code ranges used in this report. The specific ICD-9-CM and CPT procedure code ranges used in this report are as follows:

Table A.2: ICD-9-CM & CPT procedure codes used in report

Procedures Types	ICD-9-CM Code(s)	CPT Code(s)
Total Vascular & Cardiac Procedures	35 – 39	33010 – 37606
Total Open-Heart Surgery	35 [less 35.1-35.2, 35.4, 35.96, 35.99]; 36 [less 36.0 - 36.1]; 37.1, 37.3 - 37.5	33300 – 33999
Angioplasty & Stents	36.0 - 36.09	35450 – 35476, 75968, 92982, 92984, 92997 – 92998
Heart Valve Surgery	35.1 - 35.2	35.1 – 35.2, 35.99
Coronary Artery Bypass Graph (CABG)	36.1 – 36.39	33510 – 33545
Heart Transplantation	37.5 – 37.52	33940 – 33945
Cardiac Catheterization	37.2 – 37.23	93526 – 93529, 93531, 93532 - 93533

Data Analysis

Age-Adjustment

Age-adjusted rates per 100,000 the Tennessee population were calculated for the HDDS, CMS, and DSSS data files. The data in this report are adjusted to the 2000 U.S. standard population using the direct method of standardization^{3,4}. Age-adjustment allows more meaningful comparisons between two or more demographic groups by eliminating the effect of differential age-distributions. This is accomplished by weighting the data to reflect the age-distribution of a standardized population, which in this instance is the estimated 2000 U.S.

population. For a more in depth examination of age-adjustment using the 2000 Standard Population, refer to National Vital Statistics Report Number 47(3)³ (http://www.cdc.gov/nchs/data/nvsr/nvsr47/nvs47_03.pdf) and Healthy People 2010 Statistical Notes Number 20⁴ (<http://www.cdc.gov/nchs/data/statnt/statnt20.pdf>). The weights and corresponding population numbers used to age-adjust the HDDS (Table A.3), CMS (Table A.4), and DSSS (Tables A.3 and A.4) data files are displayed below:

Table A.3: Projected year 2000 U.S. population and corresponding age-adjustment weights by age, all ages

Age Group	Population	Adjustment Weight	Standard Million
Under 1 year	3,795,000	0.013818	13,818
1 - 4 years	15,192,000	0.055317	55,317
5 - 14 years	39,977,000	0.145565	145,565
15 - 24 years	38,077,000	0.138646	138,646
25 - 34 years	37,233,000	0.135573	135,573
35 - 44 years	44,659,000	0.162613	162,613
45 - 54 years	37,030,000	0.134834	134,834
55 - 64 years	23,961,000	0.087247	87,247
65 - 74 years	18,136,000	0.066037	66,037
75 - 84 years	12,315,000	0.044842	44,842
85 years and over	4,259,000	0.015508	15,508
Total (All Ages)	274,634,000	1.000000	1,000,000

Table A.4: Projected year 2000 U.S. population and corresponding age-adjustment weights by age, 65 and over

Age Group	Population	Adjustment Weight	Standard Million
65 - 74 years	18,136,000	0.52250072	522,501
75 - 84 years	12,315,000	0.35479689	354,797
85 years and over	4,259,000	0.12270239	122,702
Total (All Ages)	34,710,000	1.00000000	1,000,000

*Note: The population estimates used to calculate age-adjusted rates for the HDDS, CMS, and DSSS files were obtained via the Health Information Tennessee website (<http://hit.state.tn.us/>)⁵. The population numbers were derived using the 2003 method of estimation.

Years of Potential Life Lost (YPLL)

Years of Potential Life Lost (YPLL) is calculated for the DSSS data files. It is a useful measure of the burden of differential mortality on a population. In essence, YPLL provides a measure of “excess mortality” (i.e., premature deaths from a given cause, in this case DOH and stroke). In this report, YPLL was obtained by summing the difference between age at death (if before age 75) and 75 for decedents whose underlying cause of death was DOH or stroke. YPLL is unadjusted in this report. For additional information on YPLL, refer to the documents found using the following links:

http://www.phppo.cdc.gov/PHTN/catalog/pdf-file/Epi_Course.pdf⁶.

<http://www.cdc.gov/mmwr/preview/mmwrhtml/00001773.htm>⁷.

Costs

With the exception of age-adjusted per capita charges (AAPCC), all cost analyses were performed at the discharge/billing level across all available years and are not age-adjusted. The total charges listed on a particular discharge/billing are considered attributable to DOH, STK or HTN or a DOH-related procedure if the condition of interest was listed as primary diagnosis on the record. Cost trends are adjusted for inflation and the results are presented in 2002 dollars. The CMS (Medicare) data for patients 65+ provides billed charges, approved charges, and amount paid by CMS. For the purposes of this study, the approved charges are used. The billed charges overestimates the total amount paid, because CMS, patients, and other insurance are not liable for billed cost when it is greater than the CMS approved cost. The charges paid by CMS underestimates the charges because it fails to account for amounts paid by the patient or other insurance. There is no way to determine if the approved charges that are in excess of the amount CMS paid are actually paid by either the individual or other insurance. If the extra amount is not paid, the doctor or hospital would have to write off the additional amount.

Therefore, CMS approved charges are used to determine Medicare costs. Similarly, because there is no way to determine exactly what charges are paid by individuals or various insurance plans (private or public) and any charges not paid by the patient, insurance or government program has to be written off by the hospital, the HDDS charges are used as a proxy for costs.

Miscellaneous Methodological Issues

95% Confidence Intervals (BRFSS Data). 95% confidence intervals (CIs) are calculated for BRFSS data. Confidence intervals are a measure of statistical precision. A 95% CI has a 95% chance to include the unknown parameter in the population. The CIs calculated for the BRFSS data use the standard formula for proportion confidence intervals, using the weighted proportion estimate and the unweighted sample size.

Rate Suppression. The county-level rates presented in this report are a directly averaged across five years (1998-2002). In an attempt to increase the stability of the rates, any county with a rate based on fewer than 10 observations over the five-year period is suppressed in tables/maps presenting HDDS and DSSS data. Results based on fewer than 25 observations over the five-year period are suppressed when presenting county-level data from the CMS files. This is done in order to comply with the confidentiality policies of the Centers for Medicare and Medicaid Services as outlined in their data user agreement.

Race Classification. “White” and “Black” refer to persons of both Hispanic and Non-Hispanic origin.

Missing Data. For some HDDS inpatient records, the variable denoting the number of inpatient utilization days was set to zero. However, in order to be included in the HDDS inpatient records, the person must have had at least one day in an inpatient facility (i.e., the zero is an error). To compensate for this, the number of inpatient days was recoded from zero to one.

The HDDS analyses presented in this report are limited to inpatient and outpatient records with complete age information, and are age-adjusted in accordance with the 2000 U.S. standard population^{3,4}. This was done regardless of the level of analysis (i.e., event-level vs. individual-level). This was also done on the DSSS data files. Observations with incomplete age information are excluded from the analyses in order to provide better comparisons between unadjusted and age-adjusted analyses. Although this method results in a certain amount of underestimation, it increases the comparability of age-adjusted rates and crude analyses. Using this methodology, the number of records in the inpatient individual-level files ranges from 493,321 in 1997 to 550,818 in 2002, while outpatient individual-level files ranges from 1,098,407 in 1997 to 1,681,673 in 2002.

Race, sex, and race-sex specific data presented in this report should be interpreted with a certain amount of caution, especially when examining HDDS data. Missing values for race, sex, and/or age are not imputed. Thus, data tabulated using these variables is underestimated. Race, in particular, is underestimated in the HDDS data files (see tables A.5 and A.6 below). Totals include observations with missing race and sex information (but not age, see above). Therefore, summing race, sex, and race-sex specific analyses may not equal the total value (especially in the HDDS files). The CMS data files (table A.7) contain no missing race, sex, and age values, while the DSSS data files (table A.8) contain very few missing race, sex, and age values.

Table A.5: HDDS inpatient descriptive statistics, individual-level, 1997-2002

Variable	1997	1998	1999	2000	2001	2002
Race						
White	375,640	381,570	353,929	408,483	410,169	423,391
Black	92,357	100,830	74,779	85,989	85,698	91,437
Other	5,059	6,241	7,374	10,149	10,917	10,274
Missing	24,733	40,288	25,989	34,188	39,093	25,721
Sex						
Female	301,527	321,117	289,808	329,080	333,928	338,282
Male	196,156	207,440	172,028	209,615	211,949	212,540
Missing	106	372	235	114	0	0
Age Cat						
Under 1 year	73,392	80,907	15,198	82,402	79,987	78,410
1 - 4 years	9,213	8,579	8,596	7,854	8,586	8,782
5 - 14 years	10,223	10,213	10,347	9,622	10,411	10,606
15 - 24 years	45,843	49,930	49,295	49,699	50,740	50,489
25 - 34 years	58,202	60,733	59,594	59,640	60,385	60,628
35 - 44 years	49,283	51,991	51,513	51,723	53,708	54,431

Table A.5: HDDS inpatient descriptive statistics, individual-level, 1997-2002 Continued

Variable	1997	1998	1999	2000	2001	2002
<i>Age Cat</i>						
45 - 54 years	48,846	51,721	51,668	53,765	57,613	59,926
55 - 64 years	50,055	53,754	54,236	55,452	57,731	61,368
65 - 74 years	63,375	66,164	65,675	67,193	68,353	68,265
75 - 84 years	57,555	60,802	60,558	63,479	65,232	65,802
85 years and over	27,334	29,263	30,000	31,254	31,716	32,111
Missing	4,468	4,872	5,391	6,726	1,415	5
<i>Total N</i>	497,789	528,929	462,071	538,809	545,877	550,823

Table A.6: HDDS outpatient descriptive statistics, individual level, 1997-2002

Variable	1997	1998	1999	2000	2001	2002
<i>Race</i>						
White	788,198	995,075	961,885	1,166,200	1,220,640	1,274,886
Black	218,550	278,410	239,698	260,850	279,662	309,653
Other	9,984	15,053	21,403	36,772	36,516	37,292
Missing	81,803	86,841	88,161	87,437	84,410	59,844
<i>Sex</i>						
Female	591,436	738,989	710,325	838,342	880,347	917,343
Male	506,982	636,150	600,618	712,774	740,881	764,332
Missing	117	240	204	143	0	0
<i>Age Cat</i>						
Under 1 year	29,897	39,740	29,100	46,612	52,142	52,562
1 - 4 years	76,212	91,376	80,372	104,674	114,488	121,572
5 - 14 years	114,409	144,053	129,227	162,664	175,626	183,787
15 - 24 years	165,383	207,104	200,999	230,575	240,248	248,247
25 - 34 years	173,987	213,788	205,436	228,153	232,629	236,833
35 - 44 years	161,324	203,111	200,110	229,778	234,899	239,043
45 - 54 years	124,933	159,135	158,989	190,440	201,593	209,728
55 - 64 years	89,190	114,947	114,069	135,782	142,992	156,133
65 - 74 years	82,088	101,520	96,477	110,696	113,794	117,919
75 - 84 years	58,808	73,194	69,871	80,723	82,609	85,156
85 years and over	22,176	27,228	25,726	29,756	30,169	30,693
Missing	128	183	771	1,406	39	2
<i>Total N</i>	1,098,535	1,375,379	1,311,147	1,551,259	1,621,228	1,681,675

Table A.7: CMS EDB descriptive statistics, individual-level, 1996-2002*

Variable	1996	1997	1998	1999	2000	2001	2002
<i>Race</i>							
White	639,905	650,373	654,752	659,946	672,212	676,269	680,132
Black	77,049	77,305	76,946	76,656	77,635	77,293	76,953
Other	12,888	9668	10,415	10,977	5,326	5,240	5,511
Missing	0	0	0	0	0	0	0
<i>Sex</i>							
Female	440,518	444,187	446,109	448,298	450,899	451,418	451,729
Male	289,324	293,159	296,004	299,281	304,274	307,384	310,867
Missing	0	0	0	0	0	0	0
<i>Age Cat</i>							
65 - 74 years	427,850	427,361	426,482	427,339	429,881	429,984	431,397
75 - 84 years	225,401	231,111	234,634	237,408	240,897	243,767	245,977
85 years and over	76,591	78,874	80,997	82,832	84,395	85,051	85,222
Missing	0	0	0	0	0	0	0
<i>Total N</i>	729,842	737,346	742,113	747,579	755,173	758,802	762,596

* All demographic data used in each CMS file (i.e., inpatient, outpatient, and carrier) come from the EDB file.

Table A.8: DSSS descriptive statistics, 1996-2002

Variable	1996	1997	1998	1999	2000	2001	2002
Race							
White	42,911	43,960	44,853	45,065	46,328	46,602	47,791
Black	8,283	8,435	8,225	8,302	8,600	8,332	8,502
Other	173	184	198	139	164	214	220
Missing	0	0	0	0	0	0	0
Sex							
Female	25,369	26,157	26,649	27,024	27,895	28,150	28,731
Male	25,998	26,422	26,627	26,482	27,196	26,997	27,779
Missing	0	0	0	0	1	1	3
Age							
Under 1 year	627	635	634	597	719	680	727
1 - 4 years	113	109	117	123	104	108	106
5 - 14 years	189	201	162	196	192	141	165
15 - 24 years	809	766	797	772	856	797	844
25 - 34 years	1,217	1,141	1,115	1,054	1,111	1,078	1,143
35 - 44 years	2,200	2,195	2,102	2,261	2,304	2,335	2,461
45 - 54 years	3,517	3,735	3,647	3,811	3,984	4,280	4,405
55 - 64 years	5,928	6,135	6,294	6,183	6,356	6,354	6,711
65 - 74 years	10,784	10,878	10,998	10,464	10,646	10,499	10,405
75 - 84 years	14,296	14,347	14,864	14,916	15,356	15,222	15,594
85 years and over	11,676	12,429	12,539	13,120	13,462	13,650	13,946
Missing	11	8	7	9	2	4	6
Total N	51,367	52,579	53,276	53,506	55,092	55,148	56,513

References: Technical Notes

1. Tennessee Department of Health, Division of Health Statistics. A brief introduction to the hospital discharge data system. November (2002). Tennessee Department of Health. Retrieved online, July 2005: <http://www2.state.tn.us/health/statistics/PdfFiles/HDDS.pdf>.
2. Anderson, R. N., Minino, A. M., Hoyert, D. L., & Rosenberg, H. M. (2001). Comparability of cause-of-death classification between ICD-9 and ICD-10: Preliminary estimates. *National vital statistics reports*, 49(2), Hyattsville, MD: National Center for Health Statistics. Retrieved online, July 2005: http://www.cdc.gov/nchs/data/nvsr/nvsr49/nvsr49_02.pdf.
3. Anderson, R. N., & Rosenberg, H. M. (1998). Age standardization of death rates: Implementation of the year 2000 standard. *National vital statistics reports*, 47(3), Hyattsville, MD: National Center for Health Statistics. Retrieved online, July 2005: http://www.cdc.gov/nchs/data/nvsr/nvsr47/nvs47_03.pdf.
4. Klein, R. J., & Schoenborn, C. A. (2001). Age adjustment using the 2000 projected U.S. population. *Healthy People Statistical Notes*, 20. Hyattsville, MD: National Center for Health Statistics. Retrieved online, July 2005: <http://www.cdc.gov/nchs/data/statnt/statnt20.pdf>.
5. Division of Health Statistics, Tennessee Department of Health. (2003). Tennessee population projections 1990-2003 (2003 series). Tennessee Department of Health.
6. Dicker, R., & Gathany, N. C. Principles of epidemiology: An introduction to applied epidemiology and biostatistics (2nd ed.). U.S. Department of Health & Human Services. Retrieved online, July 2005: http://www.phppo.cdc.gov/PHTN/catalog/pdf-file/Epi_Course.pdf.
7. Centers for Disease Control and Prevention. (1986). Premature mortality in the United States: Public health issues in the use of years of potential life lost. Morbidity and mortality weekly report (supplements), 35(2S), Washington, D.C.: U.S. Government Printing Office (GPO). Retrieved online, July 2005: <http://www.cdc.gov/mmwr/preview/mmwrhtml/00001773.htm>.